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GEORGE WASHINGTON
1732–1932

This issue of INDUSTRIAL ARTS AND VOCATIONAL EDUCATION is dedicated to George Washington in commemoration of the 200th anniversary of his birthday. It is fitting that this be done and it is exceedingly heartening to note the spontaneity with which preparations are going forward to celebrate the bicentennial observance of his birth.

Even a cursory study of the life of this great man fills one with amazement at his versatility. Washington as a frontiersman, as a surveyor, as an agriculturist, and as a business man, aside from his military prowess, patriotism, and statesmanship, would be a fine example for the students of industrial arts and vocational education. It is therefore eminently proper that every shop teacher and every supervisor of shop subjects do his utmost to help prepare adequately for the George Washington bicentennial celebration.

THIS MONTH'S COVER

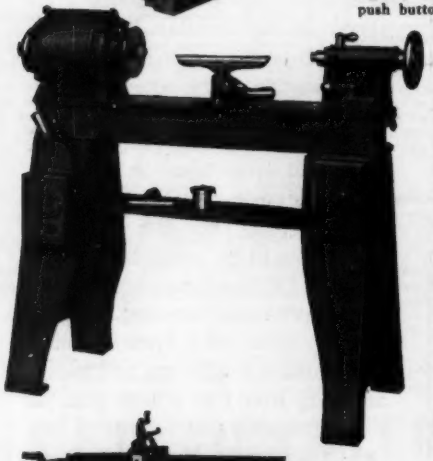
The picture of George Washington on the cover this month is a reproduction of the Houdon bust. It was sculptured by Jean Antoine Houdon from actual observations and measurements of Washington's features and figure. A life mask of Washington also was made to serve as a check on the sculptor's work.

—(*Wide World Photos.*)

Modern Instruction Methods Demand MODERN MACHINES

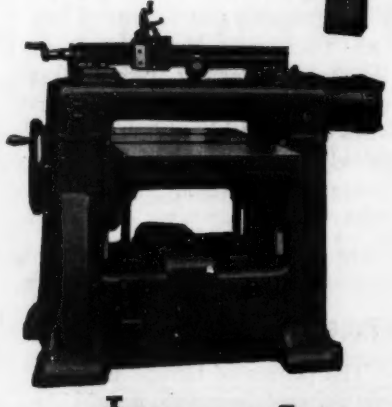
Y-30 and Y-36 High Speed Band Saws

The world's finest band saws; heavier, stronger, smoother running and faster than any other band saws made. Built in 30 and 36-inch sizes. Heavy, one-piece cast iron frame and aluminum wheels and guards put the weight where it belongs in order to assure rigidity and strength. Magnetic push button control.



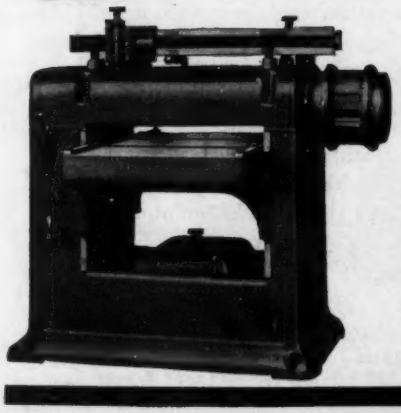
No. 12 Speed Lathe

The most popular woodturning lathe because of its many superior features. Ball bearing headstock. 4-speed motor with simple, convenient, single-lever control. The safest lathe made. Available in several sizes and styles including such refinements as hand feed carriage and set over tail stock if desired. No. 12 has been adopted as standard for use in many schools and bears the highest endorsement by leading teachers and supervisors.



The New B-4 Single Surfacer

Especially designed to cover the range of work encountered in the school shop. Sturdy, compact, capable of withstanding terrific abuse and yet extremely accurate. Safe —because there is not an exposed moving part and because adjustment and control are so simple. Point-for-point the most practical and economical surfacer for school use.



B-8 Single Surfacer

A larger machine than the B-4 and capable of greater production because of greater power. Up-to-the-minute in every detail. A machine that industry has proved to be absolutely safe, thoroughly reliable, accurate and a real producer. Ideal for technical schools, for advanced woodworking, and wherever a high quality surfacer, capable of turning out a great quantity of perfect work is required.

IT IS possible to teach the processes of woodworking through the use of antiquated tools—but it's unnecessarily complicated. Up-to-date machines are safer, easier to operate, more compact and a better bargain for your money all around.

The four Yates-American Machines shown here are excellent examples of modern engineering. They typify the progress in woodworking machinery that has resulted from today's demand for speed with safety and reliability. They exemplify the modern demand for ease of operation and more production per pound of metal. They are the Yates-American answer to industry's challenge.

Wall charts showing use and operation of Band Saw, Lathe and Universal Saw available to instructors and supervisors upon request.

Yates-American Machine Company

VOCATIONAL DIVISION

Beloit . . . Wisconsin

INDUSTRIAL ARTS and VOCATIONAL EDUCATION

VOLUME 21 FEBRUARY, 1932 NUMBER 2

Coördination in Apprentice Training

*George E. Howard**

COORDINATION of training in the school with work done on the job is one of the most difficult tasks of part-time industrial education. The whole plan of part-time training is built upon a close correlation of instruction with work experiences. We have made much progress in securing the coöperation of committees of employers and workers. We have school committees in various phases of trade training that are apparently well organized and systematized. Yet, close examination shows no well-defined procedure for coördinating the instruction of the school with work done on the job. This is clearly a function in which the school must take the initiative. Industry is ready to coöperate not only in the administrative side of the training program, but in the instructional work as well, if we but clearly outline the task.

In our carpentry apprentice training each apprentice attends school one full day alternate weeks for a school year of 48 weeks. In other words, each apprentice attends school 192 hours each year of the four-year apprenticeship. We are aware of the fact that unless there is concerted effort on the part of industry and the schools the job of training will not be adequately done. The most that can be accomplished in the school shop is to teach tool technique and difficult phases of craftwork. Of course some tool skill will result from repetition of the more common processes; but skill is an incidental product in the part-time school shop. Comparatively more training can be accomplished in trade theory and related technical information since little attention can be given to this part of apprentice training on the job under present specialized working conditions.

The work of the coördinator is all too often a task of adjusting misunderstandings, placement, attendance in school, insubordination in the school and on the job, etc. Meager indeed is the actual instructional assistance rendered by the coördinator to the teacher and the school. Yet, the instructional assistance a coördinator should render ought to constitute by far the greater part of his job.

If the school builds upon or utilizes job experiences in its instruction program, it must know the exact nature, variety, and extent of the work experiences of students on the job. This knowledge, to be of much value, must be a detailed, specific record, showing week by week the actual work done, working conditions, nature of the structures upon which students have worked, etc. No teacher can instruct or conduct a class group to best advantage unless he has before him a complete record of all the trade experience each student has had. This record enables him to draw upon the experience of each student through illustration or plan for student contributions because of specific experiences they have had at work. It enables the teacher to form a clear estimate of the quality of skills and technical knowledge which he may expect from each member of the trade group. Let us take, for example, an apprentice who has been framing houses for over a year and compare our standards of accomplishment for him in laying out a rafter with an apprentice who has done nothing for the year except lay flooring, put on sheathing and the like. Naturally, if we do not have these facts before us in our instruction, we will embarrass the one apprentice and hold too low a standard for the other. In the regular full-time public schools we classify students as to grade completion, then further group them on the basis of their mental ability. They are more or less homogeneous in their social life since they come from the same section of the city where their out-of-school experiences and community life make for a common basis on which to carry on instruction. In our apprentice groups we have students representing a range in school completion from seventh grade to two years of college as well as a wide range of intelligence and

*Instructor, Part-Time Carpentry Apprentice Class, Cleveland Trade School, Cleveland, Ohio.

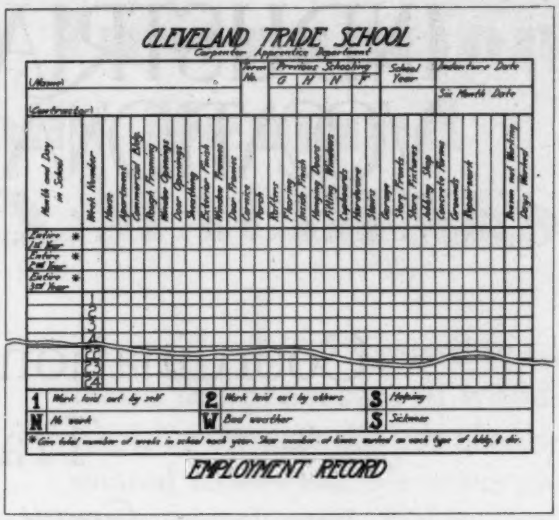
social status. They come to the school from various jobs, many of them with a very narrow variety of experiences since they are apprenticed to a contractor who specializes in one type of carpentry and some with a broad experience in general carpentry but little or no knowledge of the complex jobs involved in our large commercial structures. Often a pooling of experiences is helpful. But the instructor must know upon whom to call for these contributions and the nature and the extent of the experiences they have had. Many students go about their jobs day after day observing few of the details of their own work and little if any of the work done by other workers near them. The very fact that they may be called upon to contribute concerning their jobs and the work about them, tends to create a spirit of observation, analysis of the work they are doing and the work others are doing about them, and awaken them to the opportunities and high calling of their craft.

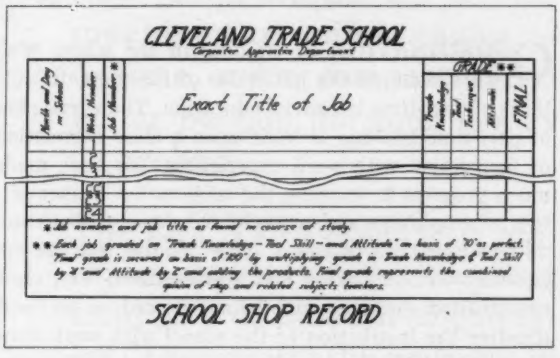
It is impossible for a coördinator to go to a foreman or employer and talk constructively about the training of any apprentice without the complete record of his training in the school and on the job. The absence of such a record has perhaps in some instances compelled the coördinator to assume the rôle of a "how-do-you-do" man who usually receives a cool reception if such visits are repeated too often. How can he discuss intelligently and advise with the foreman on work experiences the apprentice should have to round out his apprenticeship unless he has a record of the student's progress on the job and in the school? How can he bring back to the school a report of genuine educational value unless he goes out armed with the facts in the case?

I am aware that some may question information secured from apprentices. In the main, however, we have found that they report accurately. He is a poor teacher or coördinator who cannot check and develop a sense of responsibility in this respect. Maybe, after all, this is quite as important an asset in craftsmanship as some of the other things we emphasize and check so diligently.

Our record card used for coördination is 7 by 10 in. with one side used as a "Work Record" the other as a "School Shop Record." This record is filled out by the student at the beginning of each period. The grade is the only thing that the instructor puts on the entire record. This gives the student an opportunity to watch his progress each week and since no student receives his journeyman card until he completes his schoolwork satisfactorily, the record is of major concern to the apprentice.

The "Work Record" is cumulative by years so that the complete experiences in employment are before the teacher at all times. The yearly cumulative report (that is, for all previous years) is filled in by figures showing the number of weeks or parts of weeks apprentices have worked on various types of buildings, that is, "house, apartment, or commercial building"





and various divisions of the trade such as "rough framing, window openings," etc. The record for the current year (that is, for the 24 weeks) is shown by checking the type of building on which the apprentice has been employed and then using the code number "1, 2, 3," to represent the division of work in "rough framing, window openings," etc. The code reveals much as the student advances in his apprenticeship of the extent to which he is assuming the obligations and responsibilities of a journeyman. Additional columns are added to allow additions for further divisions of work. "Reasons for not working" are marked "N. W. S." as explained on the card to reveal the exact cause of unemployment. "School progress" is marked as: G, grade completed in elementary school, H, grade completed in high school, N, number of years in night school, and F, instruction completed in foreign schools. The "6 Month Date" is kept as a part of the record since the wages paid and the length of time he is to remain in school are determined by six-month periods of progress in apprenticeship.

We have found the card included in this description to be quite satisfactory as a record for part-time carpentry apprentice training. We are aware of the fact that adaptations would need to be made in order that it might meet the needs of other part-time trade groups. It is further apparent that a progress chart

prepared for a full-time school looking toward placement of students is quite a different problem. Granting these things to be true, we cannot rely upon memory or conjecture for our record of work experiences. If this record is to be of value, it must be cumulative week after week and carefully and consistently kept. We are convinced that some such device is necessary in all trade training, not only as a basis for efficient instruction, but as a foundation for effective coördination.

Grading in Mechanical Drawing

*Harvey W. Waffle**

GRADING in mechanical drawing covers the activities of the teacher from the correcting of examinations to the checking of drawing plates, and when carefully done, serves as a check upon the teaching and a means of locating the weaknesses of the student. The teacher's grade should urge the student to try to do better in the subject just as a higher wage encourages the adult. Grading should also help to guide the student in the selection of subjects offered in the course. Almost invariably the subject in which the student receives the highest grade is the subject of greatest interest to him. The junior-high-school courses should serve to guide the student in the line of his interests, but they must also hold some form of check at the end of the "tryout" period that the student will not be so likely to become a "misfit." The measuring instruments in the hands of the instructor should help to diagnose the weaknesses of the student. Personal opinion should never be relied upon as a sole means of determining a grade.

*Instructor of Drawing, Waukesha, Wisconsin.

Waukesha High School, Manual-Arts Department

Text: Introductory Mechanical Drawing Problems, Shaeffer & Bass

Name Clarence Jamsden Course Mech Drawing

Class Eighth Grade Semester B Period 4th

Bench Number 23 Drawer Number 23 1st Period Grade 70

2nd Period Grade 74 3rd Period Grade 81 Average 81

	Title of Drawing	Grade					
Plane Surfaces at Right Angles to Each Other							
No.1-C	Notched Block			2			
1-F	Gained Block			2			
1-J	Block with Lug				3		
Objects Rectangular in Form with Invisible Outlines							
No.2-A	Guide Block	0					
2-D	Gained Block		1				
2-G	Gained Grooved Block		1				
Objects Having Inclined Surfaces							
No.3-B	Cord Winder		1				
3-G	Book-Rack End			2			
3-H	Tent Stake			2			
Working Drawings of Circular Objects							
No.4-B	Cast-Iron Washer			2			
4-C	Grinding Wheel			2			
4-I	Flange Coupling				3		
Complex Objects Having Curved Outlines							
No.5-C	Slotted Link				3		
5-D	Crank				3		
5-E	Gland			2			
Dimensioning							
No.6-A	Cross-Lap Joint		1				
6-C	Ribbed Piece		1				
6-F	Flanged Pipe			2			
		0	1	2	3	4	

Explanation of Grading

Minimum of one problem from each section for a grade of (D)

6	(1) From Each Division	(D)	Sums of Grades. . . .	33
12 or 8	Poor or Fair Good or Excellent	(C)	Number of Grades. . .	18
15 or 12	Good or Fair Excellent	(B)	Quality Grade	82
18 or 15	Good Excellent	(A)		

100-93 Excellent (A)
92-85 Good (B)
84-77 Fair (C)
76-70 Poor (D)
69- (F)

FIG. 1

Methods of grading, at their best, are comparisons based upon data obtained from the measuring instruments in the hands of the instructor. In drawing, these instruments must measure the quality as well as the quantity of the work. Recitations tell very little beyond the student's knowledge of the relative subject matter, and cannot serve as a measure of tool manipulation. Many students are able to *bluff* enough to tell something of *how* a thing may be done, but often fail when it comes to the actual *doing*.

If it is conceded that grading systems are comparisons, then there should be no argument about the exact number or letter given, for these grades record only the relative functioning of the students. It is a recognized fact that judgments cannot be made within 7 per cent in grading, therefore the sensible thing is to grade only in levels with no closer discrimination than the given 7 per cent. This gives four grades within the passing range of 70 per cent, and one grade of failing. In Wisconsin, letters are recommended to represent these five levels. In all cases, a common-sense application of the normal curve fits the situation adequately.

If the grading system is to be used as a basis of promotion the system must be definite and be known to the student. If the work is to be graded on quality and quantity worked out on a sliding scale, each of the items must have a definite weight in determining the grade. When the student knows the value of these considerations in the figuring of his final grade, he is in a position to direct his own efforts more intelligently. The emphasis may be placed upon one phase of the work which the instructor believes more important by giving that consideration more weight. By this method the instructor has more chance in locating the weakness of the student and may direct his efforts toward correcting the fault. Thus, if the work is of good standard but lacking in quantity, the weakness may be failure on the part of the student to systematize his work, or a lack of knowledge of the principles of drawing which can easily be traced by means of the checking list.

A progress chart, similar to the one shown in Figure 1, may be worked out and used as a basis of grading and as a record of the work done by the student. In this particular chart the problems are laid out in their logical sequence, which serves to record the student's

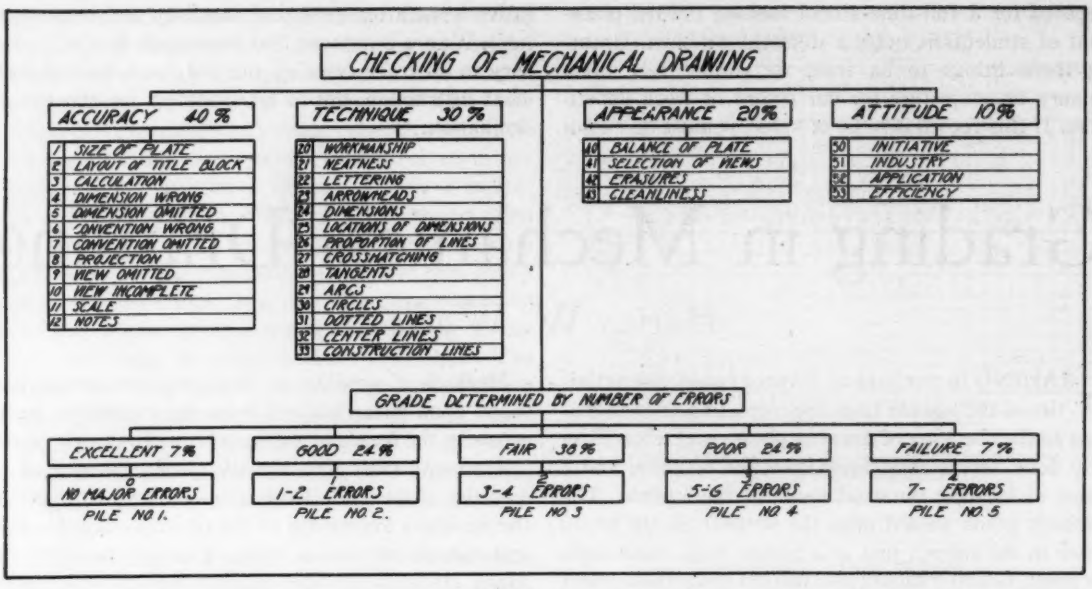


FIG. 2

progress from the simple to the complex. A space is given for each plate and the outlines of the plates are given in consecutive order so that a student knows what is to be his next plate without asking the instructor. All students are required to do a minimum of one plate from each group in order to receive a passing grade for the quarter-term period. Of course, the plates finished must be on a passing level. This requires that the student must do more than just try to *get by*, for the risk is too great on the quality of plate received from that type of student. Experience has proved that the students start out by doing at least two from each group that they may get up to the "B" level by maintaining a little better standard of work. The premium placed upon the quality of the plates which grants an "A" level (excellent) to 12 plates or for 18 plates which are graded an average of good, creates an incentive to do better work on each plate rather than do more plates of a passing grade. This limits a student doing only fair work to a "B," but gives a student doing good work an opportunity to make up in quantity that which he is lacking in quality. This encouragement of quality is given in each level of work.

To grade the plates for quality and check them for accuracy, a checking list similar to the one shown in Figure 2 may be laid out in the form of a chart, or in the form of a list, as shown in Figure 3. In either method the instructor checks the plate according to the chart or list of errors and places the code number or symbol in the space of the title block laid out for that purpose. To grade the plate, each error may be counted as a demerit and the number of demerits determine the grade level according to the chart. It is advisable to list these possible errors for checking before starting the

Average Grade Table
Number of Grades Here

Sum of Grades Here	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
0	100																								
1	90	95	97	98		99															10				
2	80	90	93	95	96	97		98						99								10			
3	70	85	90	93	94	95	96		97			98									99				
4	60	80	87	90	92	93	94	95	96			97				98						99			
5		75	83	88	90	93	93	94		95		96			97					98					99
6		70	80	85	88	90	91	93		94	95			96				97					98		
7		65	77	83	86	88	90	91	92	93	94		95			96				97					98
8		60	73	80	84	87	89	90	91	92	93		94		95			96					97		
9		55	70	78	82	85	87	89	90	91	92	93		94			95			96					97
10			67	75	80	83	86	88	89	90	91	92		93		94			95				96		
11			63	73	78	82	84	86	88	89	90	91	92		93		94			95				98	
12			60	70	76	80	83	85	87	88	89	90	91		92	93		94					95		
13				68	74	78	81	84	86	87	88	89	90	91		92	93		94					95	
14				65	72	77	80	83	84	86	87	88	89	90	91		92	93				94			98
15				63	70	75	79	81	83	85	86	88		89	90	91		92	93				94		95
16					68	73	77	80	82	84	85	87	88	89		90	91		92		93			94	
17					66	72	76	79	81	83	85	86	87	88	89		90	91		92		93			94
18					64	70	74	78	80	82	84	85	86	87	88	89		90	91		92		93		
19					62	68	73	76	79	81	83	84	85	86	87	88	89		90	91		92		93	
20					60	67	71	75	78	80	82	83	85	86	87	88		89		90	91		92		93
21						65	70	74	77	79	81	83	84	85	86	87	88		89		90	91		92	
22							69	73	76	78	80	82	83	84	85	86	87	88		89		90	91		92
23							67	71	74	77	79	81	82	84	85	86		87	88	89		90		91	
24							66	70	73	76	78	80	82	83	84	85	86	87		88		89		90	91
25								69	72	75	77	79	81	82	83	84	85	86	87		88		89		90
26								68	71	74	76	78	80	81	83	84	85	86		87		88		89	
27								66	70	73	75	78	79	81	82	83	84	85	86		87		88		89
28									69	72	75	77	78	80	81	83		84		85	86	87		88	
29									68	71	74	76	78	79	81	82	83	84		85		86	87		88
30									67	70	73	75	77	79	80	81	82	83	84	85	86	87	88	89	90
31										69	72	74	76	78	79	81	82	83	84	85	86	87	88	89	90
32										68	71	73	75	77	79	80	81	82	83	84	85	87	88	89	90
33										67	70	73	75	76	78	79	81	82	83	84	85	87	88	89	90
34											69	72	74	76	77	78	80	81	82	83	84	85	87	88	89
35											68	71	73	75	77	78	79	81	82	83	84	85	86	87	89
36											67	70	72	74	76	77	79	80	81	82	83	84	85	87	88
37												69	72	74	75	76	78	79	80	81	82	83	84	86	87
38												68	71	73	75	76	77	78	79	80	81	82	83	84	86
39												67	70	72	74	75	77	78	78	80	81	82	83	84	86
40													69	71	73	75	76	78	78	80	82	83	85	85	86
41														69	71	73	74	76	77	78	80	81	82	84	86
42														68	70	72	74	75	77	78	79	81	82	83	85
43															69	71	73	75	76	77	79	80	82	83	85
44															69	71	72	74	76	77	78	80	81	83	84
45															68	70	72	74	75	76	78	79	81	82	84
46																69	71	73	74	76	77	79	80	82	84
47																69	71	72	74	75	77	78	80	81	83
48																68	70	72	73	75	76	78	80	81	83
49																	69	71	72	74	76	78	79	81	83
50																	69	71	72	73	75	76	77	79	82
51																	68	70	71	73	75	76	77	78	80
52																		68	70	71	73	75	75	76	78
53																			69	70	72	74	75	76	77
54																				69	70	72	74	75	76
55																					69	71	73	75	78

FIG. 4

procedure, otherwise it will be found that the standard of grading varies either up or down as the work progresses. Each successive drawing suggests some new consideration and the grading becomes more severe or so lax that the instructor soon feels that the first plates have not been graded on the same standard. A system of grading by comparison rather than by demerit is found to be more simple and more satisfactory, because it allows closer adjustment, and follows more closely the normal probability curve.

In grading by comparison, the instructor first checks over the drawing carefully, marking the error or corrections according to the checking list or chart. The drawings are then sorted into five piles, each pile representing a level or grade of work. Adjustments may be made in the piles by shifting the plates from one pile to another until the final sorting represents a fair comparison of the plates. The best pile need not be marked perfect unless in the opinion of the instructor the drawings are without fault as far as is humanly possible. The grade intervals will be approximately 7 per cent, but it is found more satisfactory to use the deficit, thus for the perfect level of plates mark them 0, the second best level mark 1, and so on, down the scale, giving one deficit for each level of work. With this method the numerical grade is figured out with an average grade chart such as given in Figure 4. To determine the grade or average of all the plates, add the deficit marks of the plates and read the sum from the left side of the chart, then read the corresponding number of deficits from the top row of the chart. The intersection of these columns gives the numerical grade which can be interpreted into the alphabetical letters. Example: In the progress chart given, the sum of the deficits is 33 for 18 deficits given. To use the average table the sum 33 is read in the left vertical column, and the 18 is read in the top horizontal column. The intersection of the two columns gives in this case an average of 82. This may be interpreted as a "C" in the letter method.

To summarize briefly, a grading system to function properly should be: (1) based upon a definite and systematic scheme which is known and understood by the student that he may gauge his work; (2) an appeal to the student to do better work; (3) essential in order that the student may attain sufficient knowledge for promotion; and (4) a means of encouraging or discouraging a student in taking up the advanced work of the subject.

To check a drawing:

1. Check for clearness and accuracy in construction. This will include:
   - *a*) Views — correct projection
   - *b*) Views — unnecessary
   - *c*) Views — insufficient number
   - *d*) Clearance in assembling
2. Check for accuracy of dimensions, general technique, and lettering.
3. Check for neatness.

Code Used to Indicate Corrections to be Made in a Drawing

(X)____ 1. Wrong.
(Inc.)__ 2. Incomplete.
(?)____ 3. Not clear.
(O)____ 4. Omit the part indicated.
(V)____ 5. Views poorly arranged.
(Proj.)__ 6. Views not projected carefully.
(A)____ 7. Not constructed accurately.
(—H—)_ 8. Line too heavy.
(—L—)_ 9. Line too light.
(—F—)_10. A visible edge is represented by a full line.
(- - - -)_11. A hidden surface is represented by a dotted line.
(—C—)_12. Construction lines are continuous lines.
(—D—)_13. Dimension line should be broken for figures.
(—A—)_14. Arrowheads are poorly made.
(— — —)_15. Center lines consist of dot-and-dash lines.
(A.S.M.E.)_16. Section according to the A.S.M.E. standard.
(D.R.L.)_17. Dimensions should read from right to left, or up, and in the direction of the dimension line.
(////)___18. Section lines should not cross dimension figures.
(3/4)___19. Division line of fraction should be horizontal.
(DO)___20. Dimension omitted.
(DV)___21. Dimensions should be placed between views unless clearness is gained by placing them otherwise.
(DR)___22. Do not repeat dimensions on adjacent views.
(OD)___23. An over-all dimension should always accompany a series of dimensions.
(L/D)__24. Diameters should be given on linear diameter whenever possible.
(R)____25. Radii of arcs should be marked "R" or "Rad."
(D)____26. Diameters should be marked "D" or "Dia."
(DC)___27. Do not crowd dimensions (¼-in. spacing).
(—⌐)__28. A series of dimensions go in a straight line.
(L)____29. Letters and figures are incorrectly formed.
(N)____30. Neatness is lacking.
(W)___31. Witness lines should not touch outlines.
(LU)___32. Use guide lines to make lettering uniform height.
(DC)___33. Do not place dimensions along center line.
(T)____34. Make tangents meet.

FIG. 3

Checking of Drawings

One of the most important steps in the evolution of a shop drawing is that of seeing that the drawing is complete in every detail. This should be done with a systematic procedure, which might vary somewhat with the different types of drawings, but will in the end give the same results.

After a student has completed a drawing he should then go over it carefully to satisfy himself that the drawing is ready for the checker.

The checker in a commercial drafting shop is usually a person who does nothing else but check the drawings for errors. He is a very valuable man and receives a higher wage than a draftsman.

Education gives a person a different outlook on life in general. Seldom do men attend evening school without going away with a better viewpoint. Evening school stimulates interest in the community, in the country, and in work. — *I. B. Morgan.*

The manufacturing city should offer to its youth an opportunity to fit themselves for the work which the city has to offer. This is an advantage to the manufacturer, as well as to the young people seeking employment. — *R. R. Rogers.*

Encouraging the Slide-Rule Habit

*F. J. McAuliffe**

THE slide rule is an instrument that is used for saving time and labor in performing most of the calculating that occurs in the practical problems of the mechanic, draftsman, engineer, business man, estimator, student, and teacher.

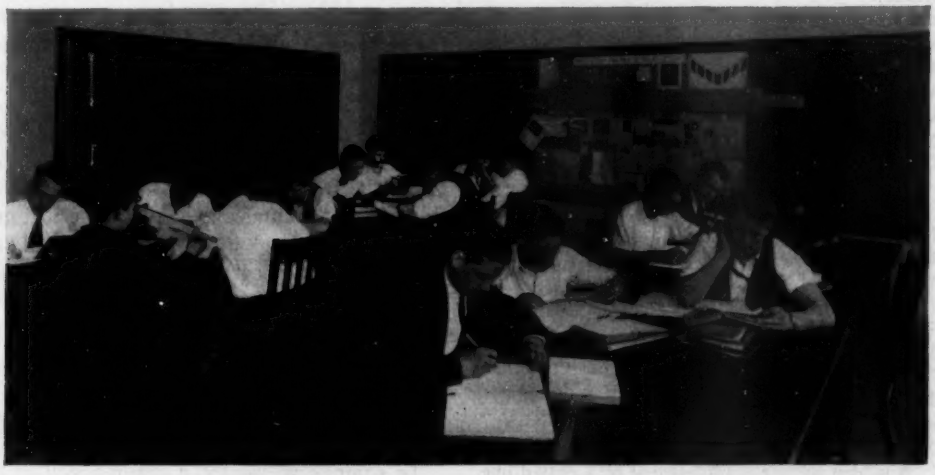


FIG. 1. THE SLIDE-RULE CLASS

For all practical purposes it gives results with a degree of accuracy that makes it very valuable to the practical man. Electrical students, for instance, have calculations of this type:

$$C\,M = \frac{10.8 \times 70 \times 15 \times 746}{11 \times .85 \times 550}$$

With the aid of the slide rule the answer may be obtained in a fraction of the time required by the usual arithmetical processes.

For Vocational Students

About three years ago a few of our capable electrical students were introduced to the slide rule. The introduction was quite informal. Since that time more and more of the vocational students desired introductions and their associations with the slide rule in the solution of their mathematical problems have greatly increased their efficiency and interest in calculation. The 10-in. Mannheim slide rule is used by the students because it is the standard style used by engineers in this country today.

On the rear wall of the mathematics classroom, at the eye level of a student of average height, is mounted firmly an 84-in. Instructor's Demonstration Polyphase Mannheim Slide Rule. The rule attracts the attention of the new student very quickly and curiosity soon has them inspecting it, and asking the instructor or fellow student what it is used for. This 84-in. rule arouses the first interest of the student and breaks the way for the pocket and desk type of slide rules that are used by practical men. Figure 1 shows very clearly how the demonstration rule is mounted. This must be done in such a way that there is enough room at each end of the rule to enable the slide to be taken out and reversed. The rule shown is fastened to two 1 by 12-in. metal strips which, in turn, are screwed to two wooden cleats that run the full width of the blackboard. Two large screw eyes are furnished by the manufacturer for mounting the large rule, but this method of mounting is not as efficient as the one shown in Figure 1. This demonstration rule is always accessible for use by instructor or student, and attracts the attention and interest of the new students during their spare time between classes. The first page of the self-teaching manual, *The Polyphase Mannheim Slide Rule*, by Breckenridge, contains a good diagram illustrating the reading of the graduations on the rule. It is well to frame this page in a small 8 by 5½-in. frame, and mount it on the wall under the demonstration slide rule, as it helps the student to learn how to read the rule.

The work in trade mathematics for beginners and advanced students taking such courses as electricity, auto mechanics, machine-shop practice, millwrighting, or welding, consists of 16 units of work for the complete course, according to a modified Dalton laboratory plan. Each unit of work is outlined to cover a time unit of five weeks and takes that amount of time for the average student if he does the calculations in the usual way. With the aid of the slide rule, however, the average student can save two weeks or more on every unit, thereby completing the 16 units (80 weeks' work) in a much shorter time, leaving him more time for study on other work. The slow student takes more time to

*Trott Vocational High School, Niagara Falls, New York.

complete a unit of work, but soon finds that the slide rule aids him in getting his work in on time. The above-average students — the more capable minority — complete the units rapidly and take a delight and interest in teaching the slower ones how to use the slide rule for their computations.

The students are allowed to take the initiative in forming the slide-rule habit. No one is forced to learn how to use it, and those who take up the work do so on their own volition.

About the end of the fourth trade-mathematics unit is a good time to introduce the students to the slide rule. The first three units of work cover common and decimal fractions with applications, percentage with applications, ratio and proportion with applications. The instructor casually checks some of the student's problems by using the demonstration slide rule. The student usually has his paper covered with many figures and the quick way the slide rule gets the same practical result seems a sort of magician's trick to him. He wants to know all about it. The instructor lets him wonder for a few days, but meanwhile keeps the students interested by checking their problems now and then with the aid of the demonstration slide rule. The more capable students soon ask to be shown how to use it.

The instructions on the slide rule are outlined in a supplementary unit of work on the Mannheim slide rule. The unit is not required — it may be taken at any time after the first three required units are completed, and there is no time limit on it, or any compulsion to complete it. This unit on the slide rule is outlined in part around two of the student's textbooks: Keal and Leonard's *Mathematics for Electricians*[1] used by the advanced electrical students; and Slade and Margolis' *Mathematics for Technical and Vocational Schools*[2] used by the beginners and advanced machine-shop students. The last part of this unit is outlined around the self-teaching manual, *The Polyphase Mannheim Slide Rule*, by Breckenridge. The first part of the unit is in Keal and Leonard's textbook, because this has a brief chapter on the Mannheim slide rule with all the answers given after the problems, hence the students are able to check their slide-rule readings quickly and accurately. The second part of the unit is more advanced, but the Slade and Margolis' textbook has a very excellent chapter on the slide rule with several solutions clearly explained, but the many practice problems have no answers given. When the student completes the problems outlined in this textbook, the instructor allows him to check them with the answer book which may be obtained from the publisher. The self-teaching manual gives complete information and the advanced students usually want a copy for themselves. The student is told that there is no mark given for completing this unit — the value being in the gaining of time in doing the required units, and in later practice in the trade. The few more capable students in each class begin this way and are allowed to use the demonstration slide rule, working in pairs. The other students in class are sure to note the way these capable students make progress in using the rule, so another method is offered for this larger group.

In the formation of a habit, practice is everything, therefore it is important that the student has a slide rule of his own. For the beginner the white-faced Beginner's rule is recommended. It looks neater, can be kept cleaner, and costs only very little more than the type which has the graduations printed directly on the wood. The student becomes accustomed to the white facings and his mental picture of the rule remains unchanged when he begins to use the professional slide rule later on.

The students really teach each other how to use the slide rule, and there is very little direct work required on the part of the instructor. The first difficulty arises when the students come to problems that involve decimals. The instructor then explains how the decimal point is placed in the final reading by approximating the answer at the beginning. Placing the decimal point by approximating the answer is preferred to the rule for placing the decimal point. After learning how to use the C and D scales of the slide rule — these are the only ones used by the beginners — and after mastering the placing of the decimal point, the next step is the use of the A and B scales, and finally the reciprocal scale.

For Vocational Teachers

The slide rule also is a great aid to all shop teachers in the vocational school. Ordinarily, only the instructors of electricity are familiar with its use, and they use it every day in checking the students' shop problems, but ordinarily they have no time to teach it to their students. It was for this reason that our mathematical department took up the introduction of the slide rule to the electrical students, and later carried it over to the other trades as well. The interest and progress shown by the students in using the slide rule in their shop problems inspired some of the shop instructors to purchase beginners' slide rules and request instructions from the mathematics department.

The professional 20-in. Polyphase Mannheim slide rule that belongs to the mathematics department has been doing service in other departments; namely, the physical and health education departments, and the guidance department.

The teachers of trade drafting, unit technical, 3-year course in trade drafting, are familiar with the slide rule, and the students in the advanced work involving machine design have found the slide rule very useful in their work. They also use it for their calculations in applied trigonometry.

The teacher of chemistry just recently stated that he desired to have the students use the slide rule in the chemistry classes. The Mannheim 20-in. slide rule was selected for these students because this style is usually found in the chemical laboratory.

[1]John Wiley and Sons, New York City.
[2]McGraw Hill Book Co., New York City.

TRADE MATHEMATICS

Course: Unit Trade (Electrical, Machine Shop, Auto Mechanics, Millwrighting, or Welding, Arc and Acetylene)

Unit — Slide Rule
C
B
A

Directions

Preliminary Requisites

1. Complete the required units 1 to 4, inclusive, of the trade-mathematics assignments. (Knowledge of decimals is very essential.)
2. Purchase or borrow a 10-in. Beginner's slide rule, Mannheim type. (See sample at desk.)
3. Rule off a sheet of note paper, 8 by 11½ in., in order to make an Assignment and Record Chart like the sample chart posted.

Suggested Plan for Practice Work

For Beginners — First-Year Student

Copy on your chart the assignment unit "C" or "B." Do not do both. Study the examples explained in the textbook and do them on your slide rule, before you attempt the problems outlined in the job that follows. Do only one job at a time; check your results with the answers; mark your per cent in the per cent column; make necessary corrections and check off in O.K. column when job is perfect. Do next job likewise, and so on, until the unit is completed. Average your per cent column and you have your rating. (You mark yourself.) Test yourself with 10 problems selected from the units.

For Advanced, Second-Year Students

Copy on your chart assignment A. Chapters 1 and 4 may be done on the Mannheim type. The remainder of work will require the use of the Polyphase Mannheim slide rule. (See your instructor for loan of this type. The demonstration slide rule also may be used by the student.)

Remarks

The slide-rule unit is supplementary and not required. No mark will be given by the instructor. Its value to you lies in the fact that the slide rule is unequaled as a time- and labor-saving instrument used for performing most of the calculations that occur in the practical problems of the mechanic, draftsman, engineer, business man, and student.

The slide rule is simple, easily learned, and only a little practice is necessary to acquire proficiency in its use.

The slide rule will give results correct to three or, at the most, four significant figures. This is accurate enough for all practical calculations where extreme accuracy is not required.

Assignment and Record Sheet
SLIDE RULE
(Trade Mathematics)

Name..... Course.....

Unit C — Keal and Leonard's textbook, *Mathematics for Electricians*

Job	*Page*	*Problems*	*Per Cent*	*O.K.*
1	15–18	1–6		
	19	1–8		
2	20	1–10		
3	21	1–10		
4	22 top	1–5		
5	22–23	1–4		
6	23 bot.	1–5		
7	25	1–6		
8	27	1–5		
9	27–28	6–15		
10	28	17–19		
		Average		
		Test		

Unit B — Slade and Margolis' textbook, *Mathematics for Vocational and Technical Schools*

Job	*Page*	*Problems*	*Per Cent*	*O.K.*
1	124–127	all		
	129	1–24		
2	130	1–20		
3	131	1–24		
4	133	1–20		
5	135	1–15		
		1–15		
6	Top 137	1–10		
		1–10		
7	Bot. 137	1–15		
8	Top 138	1–15		
9	Bot. 138	1–8		
10	138	9–16		
		Average		
		Test		

Unit A — Breckenridge's textbook, *The Polyphase Mannheim Slide Rule*

Elementary — Chapter 1

Job	*Page*	*Problems*	*Per Cent*	*O.K.*
1	8–9	1–8		
2	10	9–14		
3	12–14	15–32		
4	15	33–37		
5	16–17	38–61		
		Average		
		Test, page 18(62–66)		

Intermediate — Chapter 2, K Scale and C I Scale

Job	*Page*	*Problems*	*Per Cent*	*O.K.*
1	23	67–76		
2	25	79–88		
3	25	92–101		
4	27	102–111		
5	27	113–122		
6	28	123–132		
7	31	133–147		

Advanced — Chapter 3

Job	*Page*	*Problems*	*Per Cent*	*O.K.*
8	36	148–155		
9	36	156–160		
10	37	161–172		
		Average		

Plane Trigonometry and Logarithms — Chapter 4, S & T Scale and Logarithm Scale

Job	*Page*	*Problems*	*Per Cent*	*O.K.*
1	40	173–182		
2	40	183–192		
3	40	193–198		
4	43	201–216		
5	46	217–226		
		Average		

NOTE: This is supplementary work. Not required. No mark given.

Teachers and Students in the Other Types of Schools

The reason the slide rule is not heard of more in the higher grades of the elementary schools and in the mathematical work of the practical mathematics given in the junior high schools is due to the fact that teachers generally are not familiar with it. In the teacher-training schools its use is not a part of the practical-mathematics course given, therefore the graduate teachers know little or nothing of its value. There is an opportunity in these schools to encourage the slide-rule habit among the students so that they, in turn, may impart it later on to their students.

In our senior high school it is used in the classes in trigonometry. It may be further used in connection with logarithms and practical mathematics — the latter subject as a senior elective has not yet been given a place in the curriculum. With the aid of the slide rule supplemented with logarithmic and trigonometric tables, such a course would be interesting and valuable, especially if the course taken was of a technical nature.

A special unit course in the use of the slide rule is given in our evening schools and has proved very popular. It can be made very practical in the adult-education program now becoming an important factor in the progressive schools today.

Industrial Arts as a Means of Control

*N. B. Grinstead**

ONE of the important duties of the industrial-arts teacher is to develop a proper understanding between himself and the administrative authorities of the school as to what values may be established through his courses, and to see that enrollments in his classes and other routine procedures are conducted in the light of that understanding.

We are all aware of the fact that any subject in school must give positive justification of its existence, and that nonfunctioning courses must be eliminated on a scientific basis, unaffected by personal feelings or prejudices. Industrial arts, as one of the newer subjects in many high schools, meets with frequent misunderstandings as to its proper functioning. It is likely that many mistakes are made unintentionally by administrators, as well as by teachers of this subject. This condition will obtain until the industrial-arts teachers establish a good cause for administrators to change their viewpoint.

One of the most frequent errors made by uninformed educators with reference to industrial arts has to do with the making of special enrollments in industrial-arts classes. Recently the writer asked a number of high-school principals what types of special enrollments are made in their senior-high-school industrial-arts classes. Of 274 principals who make such enrollments, 123 make a practice of placing students who have low I.Q's, and whom they find uninterested in their schoolwork, in shop classes. About half of them also enrolled those with whom teachers of other subjects had difficulty in controlling, in the shops. These were not the only types of special enrollments mentioned, but they were the reasons most frequently given, other than vocational reasons, and are the only responses with which we are concerned at present.

Such conditions call for serious thought and careful interpretation in order to avoid misconstruction of their import. We may look at the matter positively or negatively, and our fairmindedness leads us to take the former course. However, the negative aspect looms before us, and particularly so because these same principals who were asked to state their reasons for such practices, made such general statements as "better results are obtained," etc.

There must be little doubt among those who do not have a *laissez faire* attitude toward their schoolwork that the practice of placing students indiscriminately in industrial-arts (or any other) classes on the sole basis of discipline has no justification. It seems almost axiomatic that any teacher who is unable to motivate his classroom work so as to reduce normal disciplinary cases to a minimum, ought to be dismissed from the system; that no subject that can spare any number of students from its ranks on the sole basis of discipline has a place in the curriculum; and that no administrator who allows irregular migration from one course to another for disciplinary reasons has a clear concept of his duty.

We may safely assume that if standardized-test results indicate that a given pupil has little capacity in the subject in which the disciplinary case arises; if these results are substantiated by the school record of the pupil; if conferences between teachers and the pupil show that he has little interest and no need for the course in his chosen vocational field (assuming that he may have chosen one); if analysis of the course from which he is sent shows that it has no place in the curriculum; or if results or philosophy indicate that the content of the subject in question may be best motivated and taught through industrial-arts activities — then the practice has positive educational value. It is very difficult to see how any attempt to justify such a procedure could be made on a less stable basis.

What about a refuge for undesirables?[1] The idea of encouraging undesirables, those of so-called low intelligence, or others whose dispositions in school are such that relationships are not altogether satisfactory, to enroll in various technical courses while others who have more agreeable tendencies are encouraged along other lines, is closely akin to the dependence on technical subjects to settle unusual cases of discipline. Possibly the present idea is the parent of the former. Actual cases could be cited where the students in certain schools have been classified according to intelligence-test scores, or even by an arbitrary method, in such a way that those who are promising are placed in an "academic" course, while others, less promising, are placed in a "technical" course. It is often taken for granted, apparently, that the poor student *wants* to take, or *should be forced* into, technical subjects with no consideration of his native ability or interests. On the other hand, some would almost believe that the superior student is not fitted for such learning as does not come directly from the printed page. Although this is an extreme viewpoint, it is still far too common.

The industrial-arts teacher should be willing to ac-

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[1]The word *undesirables* is used cautiously. It includes those who, on account of being sent from other classes to the shop, are seemingly not wanted in such classes.

cept his part of the students who have low ability. There should be no discrimination, however, in limiting the industrial-arts enrollment to this class of students, and then adding to this burden by forcing others into the shop classes as they prove their inability in other subjects. This places an unwarranted handicap on the teacher and is not fair to the subject. But if the student does show improvement after such enrollment, there is strong argument in favor of that course, and for that method of presentation of things which are important to be learned.

Even though such special enrollments as are discussed may be made on strictly unscientific bases, the results may be good due to the recognized educational value of shopwork. The addition of the practical-arts group of subjects to the course of study has had a great effect in keeping pupils in school. This is due to the peculiar appeal inherent in these subjects which places them among the chief motivating agencies in the curriculum.

There are several phases of motivation through industrial arts. The very fact of reality — working with concrete objects and materials which may be seen, measured, and manipulated by the student — has motivating value. The constructive instinct is appealed to and the appeal is certain of a hearty response from most people. There are few who do not derive considerable pleasure in handling materials and seeing things grow as a result of their own efforts in planning and building. This phase has particular significance among those who have high mechanical intelligence, or who have had some previous interesting contacts with materials in construction work. It is fortunate that most of the students who are erroneously placed in industrial-arts classes become well satisfied with the change. It is almost axiomatic that the satisfied student is the one who is most likely to learn.

Another factor in motivation is the fact that the pupil is always on his own initiative and planning in industrial arts, when courses are properly handled. This, with the exploratory tendency, which is also self-initiated, is a means of self-discovery of interests in a natural way. The tangible and usable end in view, encourages careful selection, organization, and procedure in making the project. The whole must be planned at the beginning, and definite planning and organization is required preliminary to each unit. Effectiveness of the solution of any difficulties is measured concretely by the student. Familiarity with materials and tools, industrial methods and conditions, and other studies which are closely related to the work, stimulates a desire for further information which the industrial-arts proponent regards as of high importance.

The foregoing factors have to do with features which add to the incentive to learn in industrial arts, and are concerned chiefly with manipulation and information about industrial materials, of methods of attacking problems, and of organizing the doing of jobs. There are other phases of motivation which deal with the effect of industrial-arts activities on learning the content of other schoolwork. The activity project is being given increased recognition as a means of learning in all branches of schoolwork. The elementary schools have recognized this for some time. The tendency has grown into the junior high school through the exploratory notion, and, no doubt, is continuing into the senior high school. This growth can be nothing but a recognition of the fact that activity in manipulation, largely through industrial-arts types of projects, is the best way to motivate any necessary learning, if the organization is possible. Examples of such work in the physical sciences, social studies, and languages, etc., through the industrial-arts types of construction are common.[2]

The Dewey philosophy which proposes that all thought and learning must be with reference to doing something, and that activity is the proper basis for all our schoolwork would easily justify making a number of special enrollments in our shops. It would hardly justify discrimination, however, except on some such basis as Thorndike's classification of intelligence, viz., abstract, mechanical, and social intelligence, or on analysis of interests, or the diagnostic discovery of peculiar aptitudes. It may be said that the whole matter of making special enrollments of the types herein discussed is dependent on scientific procedure for finding its true worth. No other basis is justifiable. It would be exceedingly pleasing if more administrators would adopt this line of thinking in the solution of their important problems of control.

[2]See Phillips, M. J. W., "Aims and Methods of Science Teaching in the Successive Stages of the Secondary School," *Teachers College Record*, 29: 397–403, February, 1928. See also *Progressive Education*. All current numbers give examples of learning through activity.

THIS ANIMAL PORTRAIT, FOUND ON A MAPLE BOARD IN THE CARPENTER SHOP OF THE FOREST PRODUCTS LABORATORY, U. S. FOREST SERVICE, MADISON, WIS., WAS PRODUCED SOLELY BY NATURAL DISCOLORATION AROUND A CLUSTER OF KNOTS. THE TEETH AND THE HIGH LIGHT IN THE EYE WERE PRODUCED BY REFLECTIONS FROM THE PHOTOGRAPHER'S ARC LIGHT

Methods of Teaching Auto Mechanics

*Stephen Henry Hurtuk**

THERE are no teaching methods or pedagogical principles that apply exclusively to industrial and vocational subjects. The methods and fundamental principles that underlie all teaching and learning are the same no matter what subject is under consideration. It is evident, however, that certain methods are more effective in some subjects than in others.

There are three chief economical methods of class instruction which may be used to advantage in auto mechanics, as well as other subjects. These are: To test the knowledge of the pupil and determine his progress by his work; to drill in information and skill that the pupil has partly acquired; and to add to the information and technical ability already possessed by the pupil.

The reasons for testing the knowledge of the pupil are many. Unsatisfactory results would be obtained if the pupil were not compelled to demonstrate to the teacher from time to time just what his achievement really is. The results of such testing show the teacher the exact progress of the pupil, how well he has acquired the essential facts, and how he is advancing in the skills which the teacher proposes he shall master. These tests afford a means for review, and a basis for marking pupils. The written test is, as a rule, more practical and more economical. The tests should be of a variety of types, and should be brief, so that the major part of the recitation period may be spent in drill and information. The tests should vary in form and should test for ideas, and power to do, as well as memory. The results of the tests should be recorded so that they will mean as much as possible to the pupil.

It has often been proved that instruction without drill will not work. It is not enough to merely instruct the pupil in adjusting tappets. It must be arranged that he have sufficient drill to develop speed with accuracy. In reward give him the pleasure of adjusting tappets on his own car or on an important live job. Drill, in the form of practice, is absolutely necessary. The teacher wishing his pupils to become perfect in skill does not attempt to gain his ends without repetition, but he attaches some pleasurable outcome leading the pupil to repeat the act until the desired skill has been mastered. The teacher must see to it that the attention of the pupil is active at all times, as wrong practice is worse than no practice.

In adding new information and knowledge the teacher may select a number of methods. He may tell the class orally. This is the lecture method and should be the least used in auto mechanics. Perhaps the best method for use in teaching a shop subject is the demonstration or illustration method. In all cases the class should be brought to the object or the object to the class. As an example: In the study of a battery the battery itself should be before the class, also a cross section, and parts of the battery. The demonstration should take place using the instruments as required and referring to charts furnished by the manufacturer. Be sure all essential parts can be readily seen by all the class. The particular problem to be considered must be kept clearly in mind. All new information must be applied in a situation which will demand action from the pupil. For instance, after instruction concerning battery instruments, the pupil should be required to use the instruments. Give the pupil an opportunity finally to perform the operations under real conditions. Allow him to test the battery on his own car or on a live job.

In the actual presentation of the lesson it may be divided into steps as follows: (1) Preparation; (2) Presentation; (3) Application; and (4) Inspection.

In the preparation step the mind of the pupil should be prepared in advance to receive the new material. The new subject matter should be developed from something he already knows.

For the presentation step the instructor may make use of the demonstration, the illustration, the lecture, or the experiment method. In either case, the pupil is to be shown how to do the thing with the actual tools necessary.

The application step is a means of determining whether the pupil has grasped the work of the presentation. This gives the teacher a chance to check up on the pupil's power to do and apply, and also to find out and correct any weak spots in the instruction.

The final step, that of inspection, is the test of the three foregoing steps. The instructor is to give the pupil no help in this step, in order to find out how well the pupil got the point of the demonstration and how efficient the instruction has been.

Different methods may be used, just as different tools are used to carry out different operations in the shop. In teaching any given lesson the instructor uses the methods that he thinks will give the best results under the circumstances. The kind of the lesson, whether technical or production, the type of the lesson, whether elementary or advanced, the kind of learner, the instructing conditions, all must be taken into consideration in deciding what method to use in any given lesson.

*Head, Auto-Mechanics Department, Collinwood High School, Cleveland, Ohio.

INDUSTRIAL ARTS and VOCATIONAL EDUCATION

J. J. Metz, Editor

ASSIGNING THE PROBLEM

The matter of individual differences is receiving more and more recognition. No longer are students expected to do the same thing in the same way in the same time. The fact that individual differences have existed has been known for a long while, but the method of taking care of these differences has developed slowly.

It is to the credit of the teachers of industrial arts and vocational education that they have done more than any other members of the educational fraternity to solve this problem. Whether or not the best solution has as yet been arrived at is hard to say, but definite work toward specific ends has been accomplished.

Naturally the proponents of the individual instruction sheet are much in favor of their particular method of solving the problem, and naturally, too, some of them are quite sure that their method is the one and only. Time alone, however, will show whether their contention is correct. In the meantime, this piece of teaching mechanism must be improved as much as possible.

Since individual differences exist, the instruction sheets prepared to take account of them must do more than merely take the time element into consideration. Many of them do not make provision for changing the difficulty of the task for the different types of students, and yet the problem that may just fairly tax the one, may be practically insurmountable to the other.

It is well, therefore, to combine the individual-instruction-sheet method with that used by the proponents of the contract system and set up different levels of difficulty in each instruction sheet in which a project or a definite job is described. This may mean, in some cases at least, a mere division of the main problem for the slower boy. A task which would loom up as a gigantic undertaking to the slow boy may be broken up into component parts which will not appear unduly formidable. This method will have the further effect of producing an appreciation in the student that the systematic breaking down of a job into its simpler parts does much in helping to plan the procedure which must be followed if the work is to be efficiently and successfully finished.

Another point which must not be forgotten, and which has been mentioned before in these columns, is the necessity of using very simple English in the writing of instruction sheets for the students. Good English does not mean complex English. If the individual instruction sheet is to accomplish what its admirers prophesy for it, its English must be plain enough so that the majority of boys are able to interpret it. It is self-evident that any instruction sheet so worded that only the children with high I.Q's can understand the directions, is useless when placed into the hands of the less gifted. However, directions that are written so as to be intelligible to the students of less than average ability, will be no less useful to the brighter pupils.

The things then to be especially remembered in writing instruction sheets is first to make the task assigned flexible enough to fit the intelligence and capacity of the majority of the students in the class. Secondly, to use language that is *so simple* that it will be intelligible to even the less gifted. Unless these two points are carefully regarded in the preparation of the instruction sheet, this teaching device will not be as helpful as it may be made. It also must be remembered that failure to make these sheets so that they can function properly will not only add much to teachers' burdens, but may eventually discredit the instruction-sheet method in the shop.

A LITTLE MORE RECOGNITION

The Industrial-Arts Section of the American Vocational Association has done such outstanding work that one of the past presidents of the Association is said to have openly complimented one of the industrial-arts committees on having done the most outstanding work of the Association.

If this be true, it would seem that the American Vocational Association ought to recognize the Industrial-Arts Section by elevating it to the dignity of representation in the executive committee and also by granting it additional time in the program. It is true that the Industrial-Arts Section had an additional luncheon meeting at the 1931 convention just held at New York, but the convention program could be made much more interesting to the men who are teaching nonvocational classes, by a more generous representation on the program.

Each one of the industrial-arts sessions at the last few conventions has been well attended. The industrial-arts teachers seem willing and anxious to accept the invitation of the A.V.A. to affiliate. Why then treat them more or less as stepchildren?

REWARD OF DEVOTION

The virtuoso had his audience spellbound with his artistry, technique, and skill on the violin. In his hands the instrument was responsive, obedient, plastic, lending itself to perfectly portray the master's will and moods. What a difference when that same violin is played by a beginner. No longer are the sounds emitted pleasingly smooth and harmonious, but harsh, strident, and discordant they strike the listener's ear.

How similar to the violin is a class of virile American boys. In the one class these boys are readily responsive; in another, unruly and boisterous. Here too, the direction of the class is responsible for the response. The master teacher knows how to make use of the pent-up energy, eagerness, and youthful exuberance to further his ends, and the ends of education.

He knows how to play on the boyish mind, emotions, and imagination, and the human instrument responds to the teacher's touch as does the violin when played by a master.

To accomplish this, however, the instructor must know more than mere content matter. Besides knowing what to teach, he must know how to teach, and further than that he must understand boy psychology. He also must possess a love for his work and an appreciative regard for the students who make up his class, just as the master of the violin not only loves his music, but also his instrument.

Teaching, like music, is exacting. No halfway measures will do. Both require the utmost of their devotees, but both also handsomely award those who devote themselves wholeheartedly to their tasks with a satisfaction that few other professions can give.

OVERCOMING HANDICAPS

How frequently do obstacles arise which seemingly make further progress seem impossible. Finances are inadequate, and the shop teacher is told that needed equipment, supplies, or materials will not be forthcoming. Some teachers will take such an ultimatum for final, others will take it as an incentive to see what they can produce in spite of the dictum of those who are in authority. Elbert Hubbard's *The Message to Garcia* has made famous a subordinate who carried on regardless of hindrances.

Not everyone, however, is fitted by temperament and intelligence to do this. The born fighter may love the challenge which is thrown out to him, and valiantly attack the new problem which this sudden ultimatum presents to him. Others, however, succumb at once, and like broken reeds remain helplessly supine without making any effort to brace up against the forces that crushed them down.

It is good for everyone to look about and see under what handicaps others must labor. To do this, it is not necessary to go back to ancient Greece to find a Demosthenes valiantly working against the two handicaps of stammering and a bodily deformity until he becomes the foremost orator of Greece. Any rehabilitation teacher can relate stories of silent, heroic efforts, made by men probably not overly brilliant, to overcome a physical handicap which nature, ill health, or accident has put on them; men who laboriously attend school on crutches or in wheel chairs; who devise or suggest apparatus and harnesses which will enable them to cope with able-bodied men.

There are other notable examples of the same kind. Dr. Edwin B. Frost, for instance, a recognized authority in the field of astronomy and the active, directing head of the Yerkes Observatory, is totally blind. Despite his blindness he keeps abreast of astronomical advances made the world over, and with the aid of his staff, his secretary, and his wife, he accomplishes a great amount of work.

How examples of this kind make one feel humble! These men who are so severely handicapped, and who yet carry on, refusing to admit defeat and wresting a victory grudgingly and unwillingly given by a fate that has seemingly determined to crush them, put one to shame.

It is in times like these when all seems dark and dismal that it is good to count one's blessings. The methods that others use to successfully scale the heights are open to all. One needs but to adopt and adapt them to one's needs and then keep manfully forging ahead.

THE WASHINGTON BICENTENNIAL

The year 1932 will see many different kinds of celebrations held the world over in honor of the two hundredth anniversary of the birth of George Washington. Naturally, every school in the United States, be it public or private, will join in these commemorative exercises. There will be pageants, plays, processions, and tableaux and it is in connection with these that the industrial-arts and vocational classes can especially assist in making the celebration worth while. The opportunity for vicarious service for shop teacher and shop pupil may be turned to good account if handled in the right way.

It may be quite true that these extra jobs may somewhat interfere with the work laid out for the regular school year. They may even assume the proportions of production jobs of no mean proportions. Yet the purpose for which they are undertaken, the opportunity which they present for inculcating ideas of patriotism, participation in civic movements, and above all in honoring so versatile a character as Washington far outweigh the inconvenience experienced by pupils and teachers because of required departures from a prearranged course.

It is necessary, of course, to definitely bring these ideas before the boys who participate in preparing for these celebrations. They must know, not only that they are building something that is to be used for a George Washington celebration, but they must also be shown that their work plays a very vital part in making a success of the undertaking, and that any public enterprise will ever largely depend upon the unselfish and whole-hearted coöperation of many persons who are willing to contribute time and effort.

These points may be emphasized still more by showing how well George Washington's life exemplified these very virtues. Not only was he willing to assume the arduous duties which public service brought his way, but he was equally ready to risk his wealth, which was quite considerable, as well as his life.

While the ceremonies on February 22 will no doubt be the most impressive and elaborate, nevertheless there will be other opportunities for the school shops to render service to celebrations arranged by other civic groups because the Bicentennial commemorative exercises are to extend from Washington's birthday, February 22, 1932 to Thanksgiving Day, November 24, 1932. Shop teachers will therefore have many opportunities to impress on their pupils that the real greatness of the Father of our Country was his willingness to work for the welfare of others.

Free-Hand, Third-Angle Projection for Beginners in Mechanical Drawing

*Jonathan Bright**

(See Supplements No. 234 and 235)

THIS series of problem sheets was developed and carefully tried out at the Academy High School. They have been found to be very helpful for teaching mechanical drawing in the junior high school, in adult classes, and for those special students who enter after the rest of the class has progressed past the fundamentals.

Most teachers realize that differences exist between pupils, in industry, mentality, neatness, and speed. The bright boy is often so far ahead of the rest of the class that, unless he is given extra work, he is bored, develops bad habits and must be disciplined. The dull boy, on the other hand, gets so far behind the rest of the class that he thinks it is of no use to even try to catch up. Frequently the teacher is of the same opinion. The class becomes so widely separated that too much of the teacher's time is spent in individual instruction.

To correct these conditions, a series of problems involving the same or similar principles were devised. They allow for individual differences by providing plenty of similar problems for the bright, fast, or industrious boy and allow the instructor to devote a large part of his time to individual instruction of the dull, slow, or lazy boy. The teacher is able to keep the class together regarding principles. Each student completes as many problems as he can in the drawing period. The problems are graded as to difficulty. The dull boy is able to complete enough of the problems to master the principles involved. The bright boy is interested because of the increasing difficulty of each problem. Each sheet contains enough problems to keep the bright boy busy for the usual double period of drafting. These sheets also allow the pupil, who is below the general level of the class, because of entering the class late in the semester, to learn the elementary principles of drafting in the least possible time. He is allowed to advance as fast as he can master the principles involved on each sheet, and his advance is dependent only upon himself.

Proportion and placement of views are taken up first, starting with very simple problems and gradually working into more complex problems involving invisible edges, center lines, circles, arcs, tangents, and broken, fragmentary, auxiliary and sectional views. From time to time a test sheet of completion problems is inserted, involving the principles taught in the preceding problem sheets. After the student has a fair idea of placement of views and proportion, he is given a chance to select his own views and is taught dimensioning. This seems to be a logical division or analysis of the principles of drawing. Finally he is taught the use of instruments and when he has developed a certain amount of skill in their use, he is taught to make detail drawings from assembly drawings, and to make assembly drawings from detail drawings. The detail and assembly drawings that the student works from in his later work are orthographic projections and not perspectives.

Problem Sheet No. 1

With this sheet the instructor is expected to give an introductory talk on mechanical drawing, emphasizing, (*a*) where and how it is used, (*b*) its value as a universal language, (*c*) the chief differences between orthographic and perspective drawing. The student is shown, by means of blackboard sketches, that perspective does not show either the true shapes or the true dimensions of the object. This is compared with the true shapes and true proportions of the orthographic drawing. The student also is taught proportion and placement of views at this time.

He is then given the necessary supplies (paper, pencil, and eraser) and taught how to gauge border lines from the edge of the drawing board or desk, how to place the views on the paper, how to sketch a straight line, and the proper weight of object and border lines. The first problem is completed under the direct supervision of the teacher, who stresses the importance of the construction and finishing stages in making a drawing. After the first problem has been completed, each student proceeds according to his ability. Results are checked by the instructor. Because the first drawing period has to be devoted largely to organization, it is often necessary to carry this lesson over to the next time the class meets.

The arrows, on the sheets, point to the side which is to be considered the front of the object. The lettering refers to the views which are to be drawn. *F* is the front, *R E* is the right end, *L E* is the left end, *T* is the top, and *B* is the bottom. The back view is not considered because of the many positions in which it may be drawn with the resulting confusion in the mind of the beginner.

Because the student's power of visualization is not developed, it may be necessary for the instructor to supplement the first four sheets with models of the problems. These models should not be used if the student can interpret the perspective without them.

Problem Sheet No. 2

Sheet No. 2 involves the same principles as the first sheet, except that the blocks, shown in the perspectives, are complicated by cutting out a piece here and there. Care is taken that the student will not have to draw anything but horizontal or vertical lines. Invisible edges are avoided by calling for views not requiring them. The points brought out in the first

*Academy High School, Erie, Pennsylvania.

lesson are first reviewed and the method of laying out or constructing a drawing of this type are taught.

Problem Sheet No. 3

Sheet No. 3 shows blocks having oblique planes. Principles previously taught are reviewed at the beginning of the lesson. Views calling for invisible edges are again avoided. The difference between representing an edge showing its true length in one view and less than its true length in other views is taught. This may be contrasted with the problems on the second sheet in which all of the lines are either horizontal or vertical.

Problem Sheet No. 4

This is a series of problems involving the representation of hidden or invisible edges. Review the points which were not clearly understood in the previous lessons. Teach the representation of concealed edges and the proper methods of joining dotted lines with dotted lines at right angles, with solid lines at right angles and where a solid line meets another solid at right angles and continues as a dotted line. Models should not be necessary to supplement the problem on the following sheets. This lesson has introduced a new line convention, namely, the dotted line.

(To be continued)

Current Comment No. 4

Skill and Drill

*Homer J. Smith**

SCHOOL-DAY memories include for most of us an insistence by teachers that we excel in certain phases of each school subject. Drill or practice was commonly forced in selected portions of the work. Teachers varied and subjects differed, but the requirement of concentrated effort upon certain skills and informations was characteristic of teaching. Who has forgotten his times of turmoil with the alphabet, the multiplication tables, the names and directions of rivers, the bones of the body and circulation of the blood, the preamble to the Constitution, and the causes of the Revolutionary War? Who can forget his attempts at mastery in declension, parsing, and sentence diagrams; the diacritical markings; removal of parentheses and factoring in algebra; the extended list of theorems in geometry; and the laws and problems of physics? And, there were the joints and sawing exercises of woodwork!

At this distance, most of us would say that those intensities were good and wish them for our children. We have made little use of some of these drill units, although we cannot know how little or how great the direct worth or casual influence of such early accomplishments. We feel that something tangible was gained and are led to deprecate the educational looseness that has had vogue in the interim. This writing is to cite that drill is rapidly being recalled to the academic classroom and to urge that teachers of shopwork and drawing accord it greater place.

The return of drill in the formal subjects is accompanied by a great advance in method, in that the practice time is matched with specific difficulties experienced by students. We, as children, gave like study to all words of a spelling list. Our sons and daughters work upon the few words of a lesson that have been identified as needing special effort in their individual cases. We filled our copy books by daily periods of penmanship. They practice upon open loops, heights, slants, or whatever the detail that will insure legibility of each pupil's product. We worked on and on in arithmetic at plodding, steady pace — all completing a prescribed number of computations of given kind. They prove their abilities in some phases by one or a few examples and then drill on known deficiencies until exactness and speed are of accepted grade.

Our academic friends have outstripped us with their diagnostic tests and their remedial drill materials. We are even with them, though ahead in time, on the close analysis of subject matter which is the basis of the new drill method. To keep pace in the future, we must determine to place due emphasis upon the following types of endeavor: (a) *Analysis of still more shop fields for "doing" and "knowing" units;* (b) *selection of units in each field and level for special drill;* (c) *perfection of finding tests to locate the difficulties and errors of individuals;* (d) *study and adaptation of the laws of habit formation;* (e) *planning of definite practice periods and techniques; and* (f) *improvement of records to include this detail of pupil responsibility and result.*

One need not argue the desirability of drill as an element of industrial coursework. Accuracy and speed in certain processes are demanded in life and can be attained only by repetitive practice. To reduce error and accident, to minimize waste of materials, to effect economy of time and effort, to build pride in craftsmanship, and to lay the basis for transfer, are all valid aims of a drill or skill program. We, as a professional group, are generally grounded in these beliefs. There is doubt, however, whether we are sufficiently interested and active to make these beliefs vital in the training of those in our charge.

Industrial-arts teachers seem to feel that passable construction of a series of well-chosen projects will give boys skill in the operations involved. They fail

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to consider the small total time this plan provides for the handling of a given tool or machine. They make little distinction between easy and difficult processes or between those needful or unworthy of continued, purposeful practice. Many of them do not grade or keep records in ways to make students conscious of commercial standards of performance. They make no seeming endeavor to interest boys in *improvement* rather than *completion*.

Teachers of trades, whose work has need for particular attention to skills, are likewise neglectful or unknowing. They seem to feel that continued work upon production jobs like those to be met in industrial service will insure the proficiency to be demanded. They seem to forget that a thing once well done may have been slowly and haltingly done and may need to be repeated times without number. Often, under circumstances quite out of their control, they assign repetitive work to students already skillful in hope that the order may be filled promptly and the product be perfect.

Both of these groups should become more interested in testing students for individual abilities and shortcomings. They should arrange for special periods of drill for each pupil on the things demanding more practice. They should not "shy" at the exercise nor honor too highly a student's natural desire to "do something else" or to "get under way." They should, in each course, designate certain selected operations or processes for better-than-average performance and have a means of knowing when each and every student has met the ideal.

Drill work must be motivated by building appreciation of immediate or ultimate need for skill. It involves incentives and rewards, group competition, and a constant fight against one's past. It offers splendid opportunity for the use of learning curves, time charts, and individual attainment graphs. It makes possible the praising of high-class students, in assembly and elsewhere, for accuracy, speed, hard work, and good spirit displayed in work rather than at play. Where standards are set and interest in improvement has become a custom, such evidence of approval can be made real because based upon concrete differences.

We ought to be able to devise shop records as definite and continuing as track records. There certainly is something in every shop comparable with the distance a shot has been put. No one will name it and exalt it if we do not. And, as we select the winners of shop events, let us be careful that we acknowledge specific, measurable performances rather than general excellence. The best all-round workman in the printshop should not be confused with the student who can handset one thousand words of copy, without error, in so many minutes and thus establish a class, school, or all-time record.

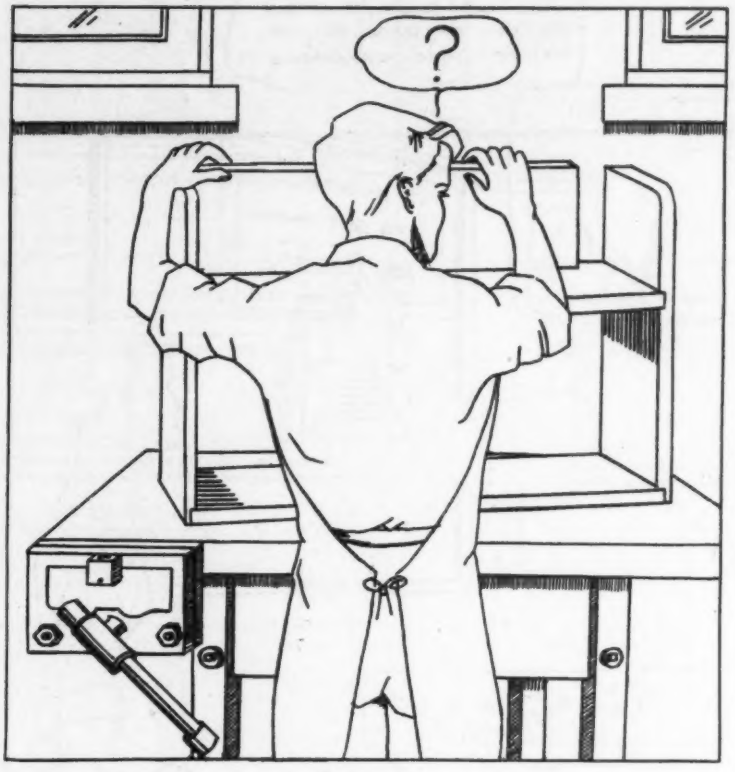
To build morale in a department or school concerning skill rather than product, necessitates that the teacher make special study of the methods used in drill. He must learn to give exactly correct starts as to both form and execution. He must permit no exceptions and strive to bring correctness and speed slowly along together. He must be a student and experimenter in practice length and practice distribution, because these will differ as much among processes as among the persons who learn them. He must plan to isolate the one thing upon which concentration is expected at a given time. He must learn to sense when the point of diminishing return has been reached. He must know how to slope the practice in order that the high point may be permanent or easily reattained. In short, he should receive in his initial or later training for teaching a unit course in which the psychology of learning is applied specifically to school-shop and wage-job activities. Particularly should he learn through such a course how to make students enthusiastic about drill and how to motivate in adults the heavier repetitive practice which their kind and conditions demand.

All of us can take steps toward the goals here suggested if we can only bring ourselves to admit that the skills now being acquired by our students are insufficient and sporadic. There is no desire that an industrial-arts student should become highly skillful in the wage-earning sense of the term, but each instructor whom he meets should bring him to higher attainment in some things than in others. The trade student, with his definite vocational aims, should be brought to appreciate that he will be welcomed in the earning group and advanced in his field in rather direct relation to the number of things he can do really well.

Let us continue the project and job plan of training in our industrial teaching, but let us supplement the plan with exercises, practice pieces, and drill periods as ingenious and attractive as we can make them. The satisfaction of employers with school-trained men and the craft pride of workers which we all love to see will both come when the skill of man is continually proclaimed and exalted far beyond the product from his hands.

PLUMBER APPRENTICE AT THE CENTRAL CONTINUATION SCHOOL, BUFFALO, N. Y.
Photo by H. E. Greiner, Seneca Vocational School, Buffalo, N. Y.

TOO SHORT



The boy shown above was not careful when he made his measurements.

Now he wonders what can be done to lengthen the piece of stock which he cut too short.

Before cutting off any stock, be sure your measurements are correct.

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Submitted by Jos. J. Lukowitz, Milwaukee, Wis.

A WORD TO THE WISE

The boy at the right did not heed safety suggestions until he cut his wrist when attempting to use a chisel with one hand while holding the work with the other.

Place your work in a vise or clamp it to the bench top to avoid such accidents.

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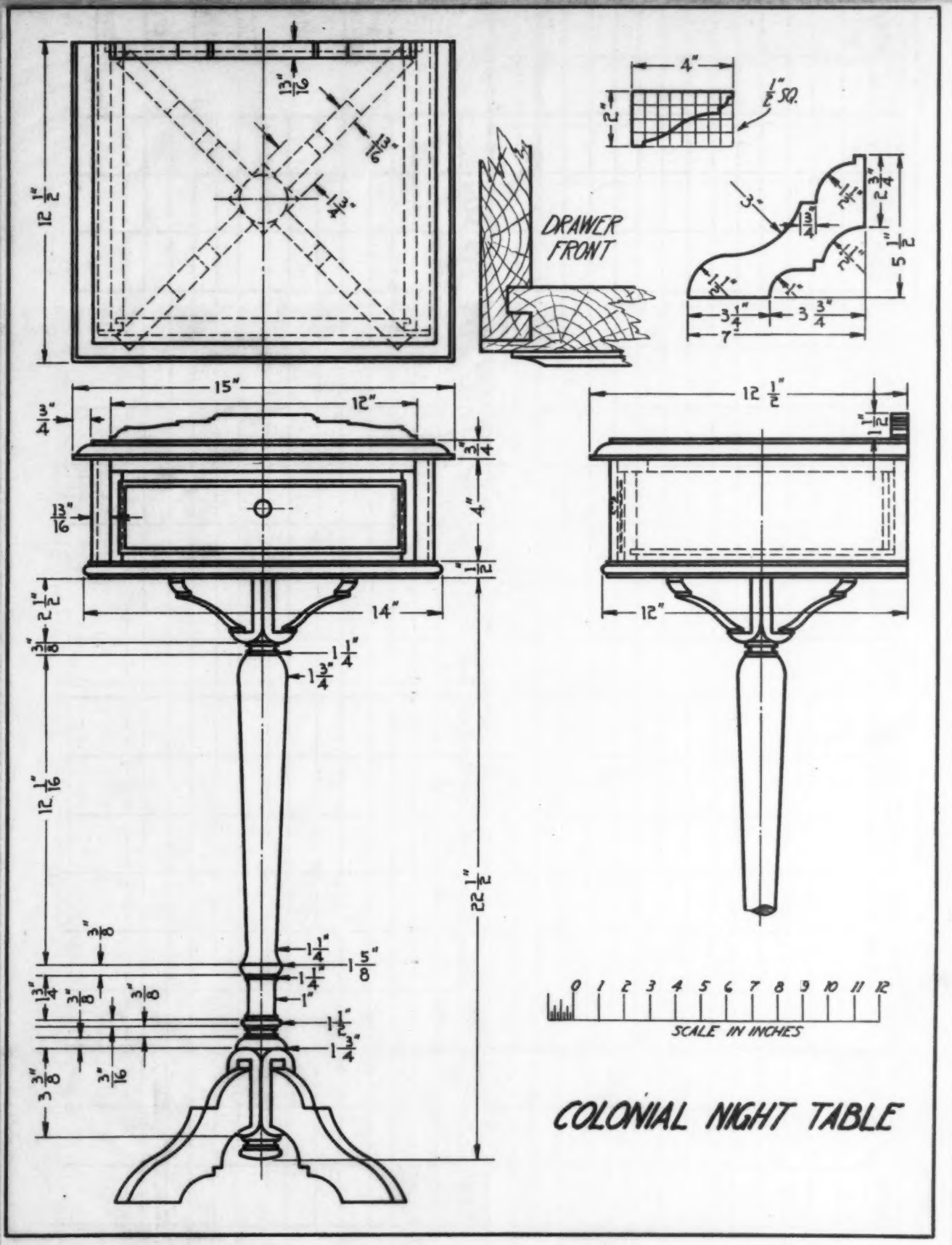
Submitted by Jos. J. Lukowitz, Milwaukee, Wis.



Designed by Lyle M. Garnett, Milwaukee, Wis.

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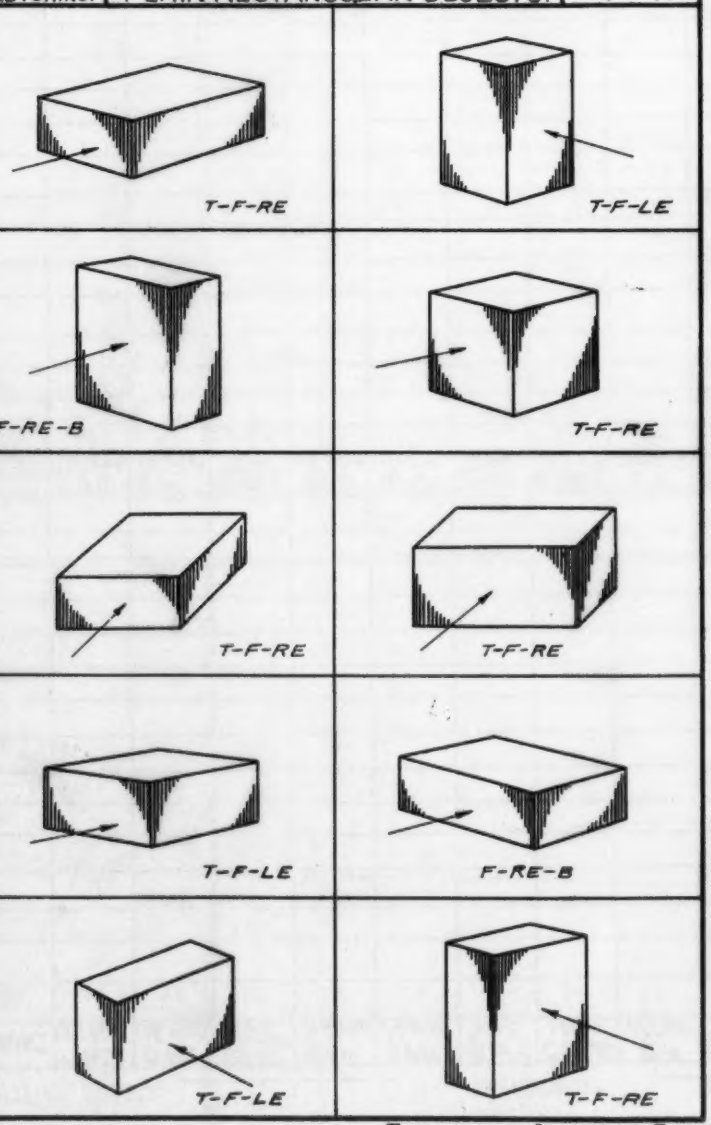
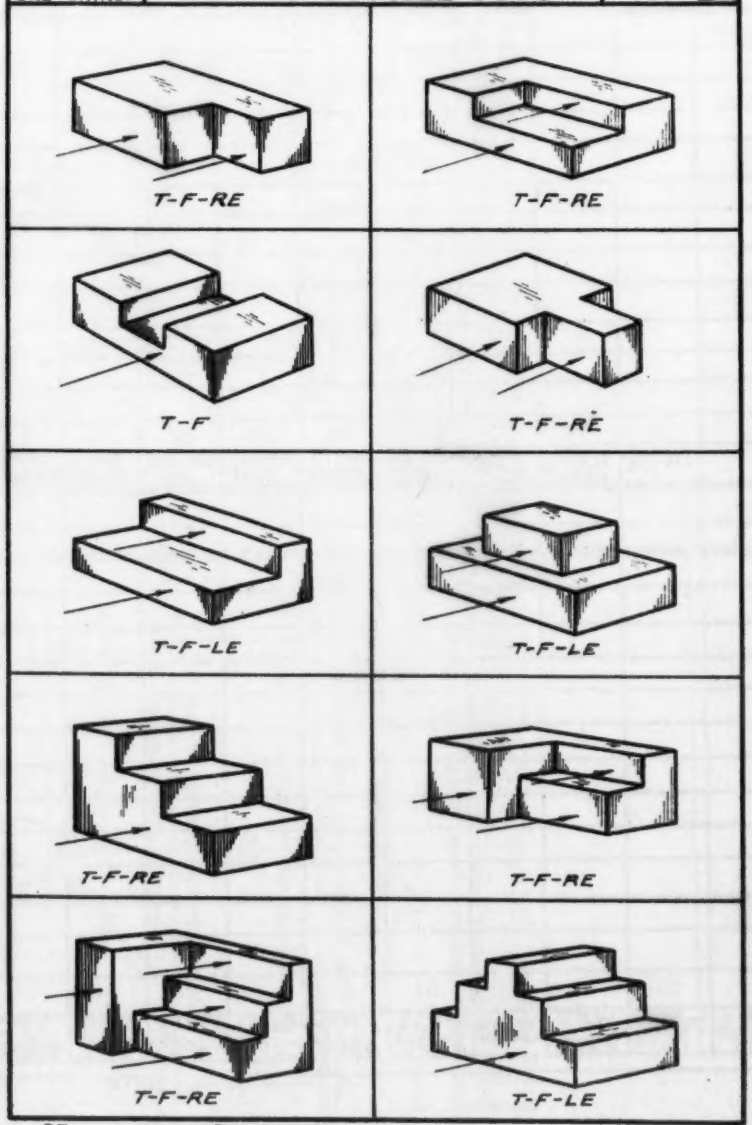
FREEHAND SKETCHING. PLAIN RECTANGULAR OBJECTS. № 1.



FREEHAND SKETCHING. PLAIN RIGHT ANGLE CUTS. № 2.



T MEANS TOP; B BOTTOM; F FRONT; RE RIGHT END; LE LEFT END.

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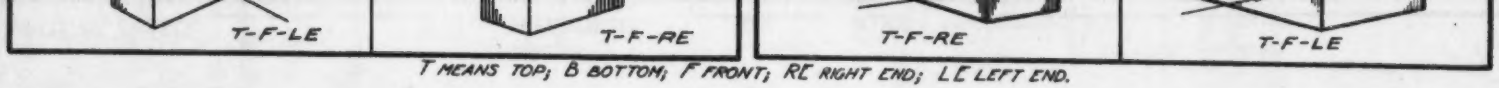

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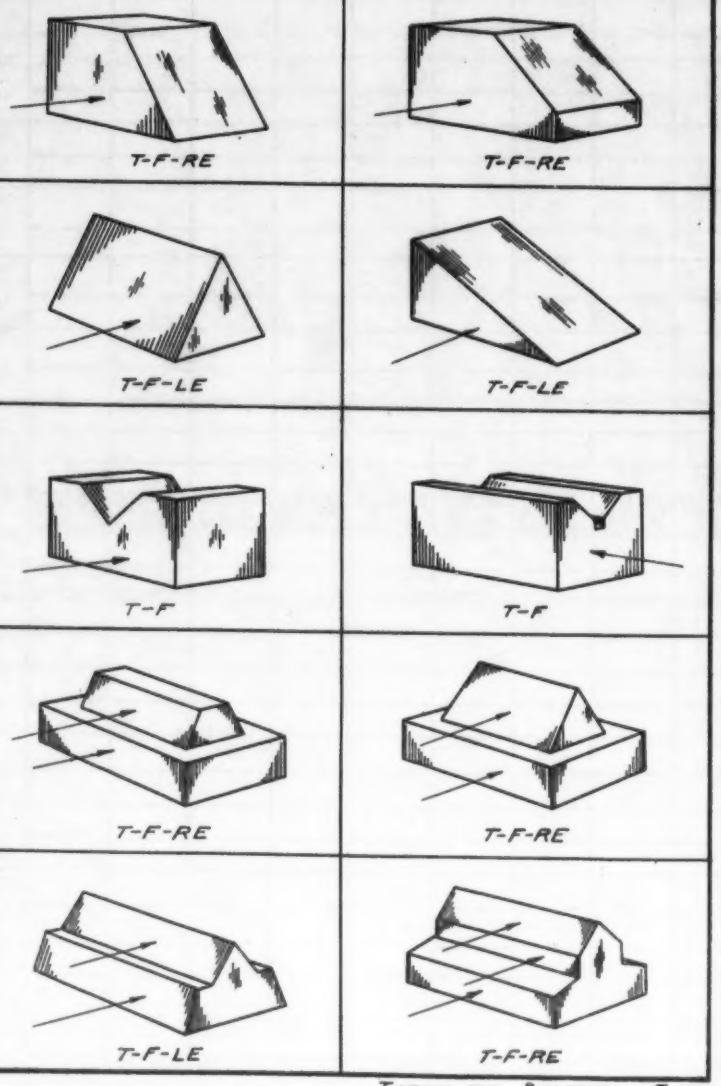
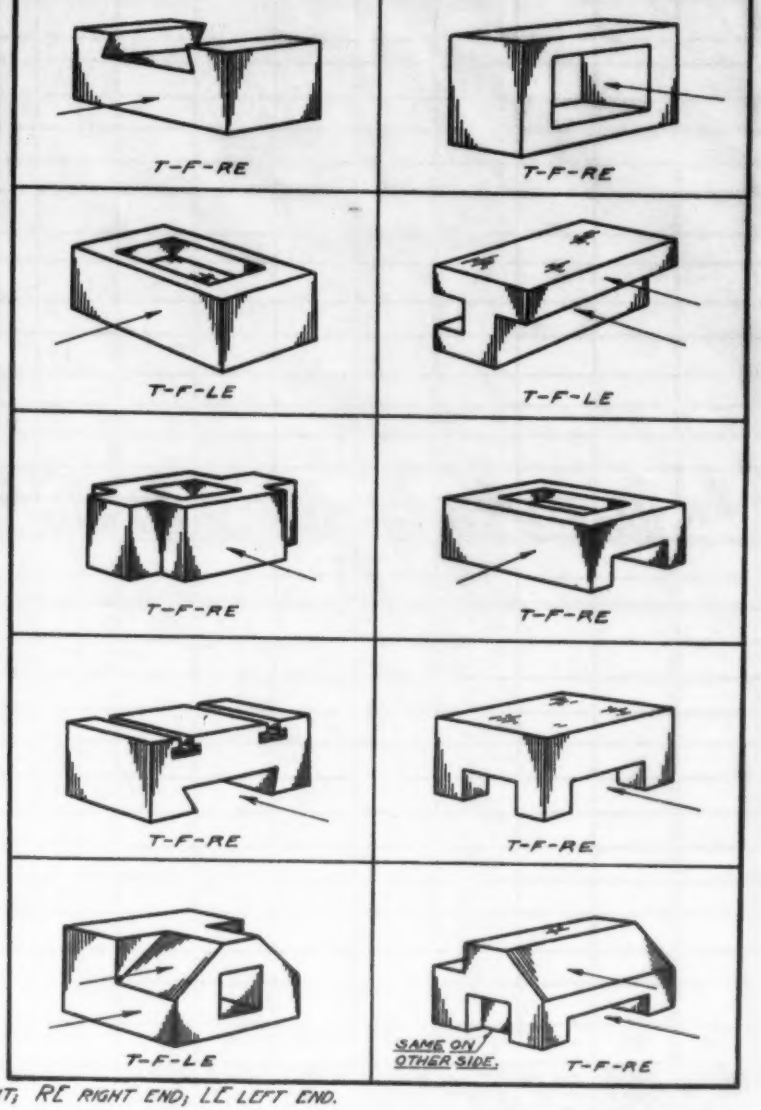
FREEHAND SKETCHING. OBLIQUE SURFACES. No 3.



FREEHAND SKETCHING. HIDDEN EDGES. No 4.



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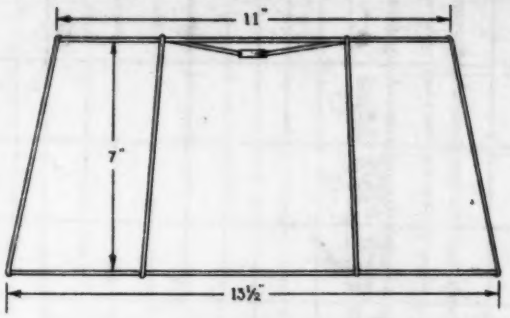
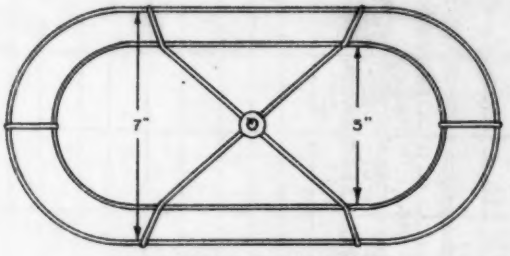
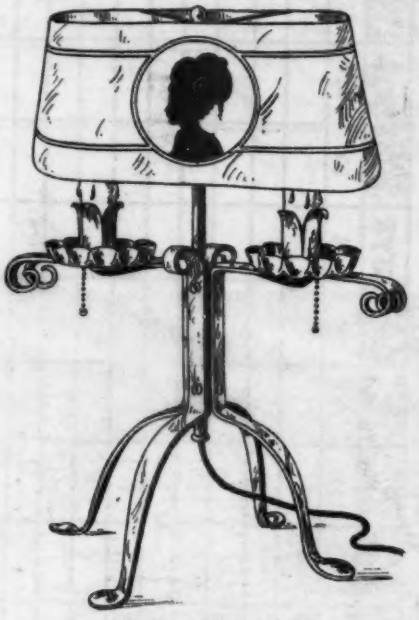
WROUGHT IRON TABLE LAMP

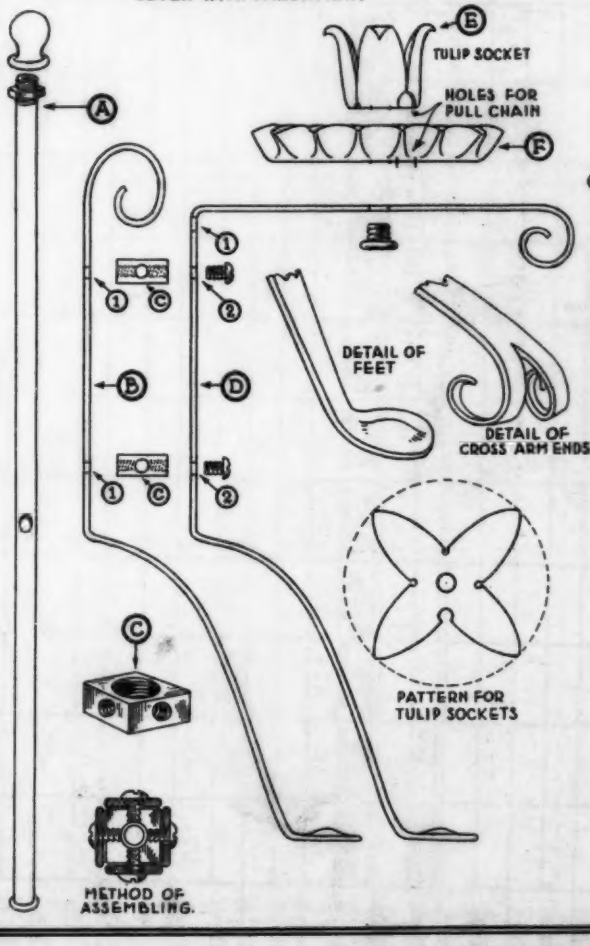




CONSTRUCTION OF WIRE FRAME
COVER WITH PARCHMENT



COMPLETED LAMP



METHOD OF ASSEMBLING.

(A) ¼" PIPE, 15" LONG, THREADED BOTH ENDS. DRILL ¼" HOLE THRU PIPE 7" FROM LOWER END TO ADMIT WIRING. USE BRASS FINIAL FOR TOP.

(B) 2 PIECES ⅜" × ⅛" BAND IRON 18½" LONG. DRILL ⅜" HOLES AT ①

(C) 2 ⅝" SQUARE NUTS, DRILLED AND TAPPED FOUR WAYS FOR ¼" STOVE BOLTS

(D) 2 PIECES ⅜" × ⅛" BAND IRON 25" LONG DRILL ¼" HOLE AT ① FOR WIRING AND ⅜" AT ②

FORGE ENDS OF ⑱ AND ⑲ AS PER DETAILS.

(E) 2 TULIP SOCKETS MADE OF 20 GAUGE SHEET IRON DISCS- 6½" DIA.

(F) 2 SCOLLOPED TRAYS MADE OF 20 GAUGE SHEET IRON DISCS 5½" DIA. DRILL ¼" HOLE TO CORRESPOND WITH HOLE IN TULIP BASE FOR PULL CHAIN

BEFORE ASSEMBLING INSERT WIRES IN PIPE WITH ENDS EXTENDING THROUGH HOLES AT ①. AFTER MAKING SOCKET CONNECTIONS WIRE MAY BE PULLED DOWN IN PIPE TO MAKE A NEAT JOB BELOW CROSS ARMS.

FINISH LAMP WITH LAQUER OR RUB HIGH LIGHTS WITH FINE EMERY CLOTH AND GIVE COAT OF LIQUID WAX.

ED. C. HUNT • HALES CORNERS, WIS.

Designed by Ed. C. Hunt, Hales Corners, Wis.

PROBLEMS & PROJECTS

NIGHT TABLE

Lyle M. Garnett, Milwaukee Vocational School, Milwaukee, Wisconsin

(See Supplement No. 233)

The night table shown herewith may be made as an individual project or as a companion piece to the bedroom pieces which appeared in the November, 1931, and January, 1932, issues of INDUSTRIAL ARTS AND VOCATIONAL EDUCATION. The table may be made by almost any student, even though he has not had a great deal of wood turning.

The feet and upper brackets may be either doweled or mortised to the post. The side and back rails are assembled and fastened to the top by the use of top fasteners. The rail above the drawer is dovetailed to the sides to keep them from spreading. The bottom board is screwed to the brackets on the leg and then the bottom is screwed to the sides of the upper box.

The drawer should be well constructed. A guide rail should be placed beneath the drawer to make it run more easily. When laying out the pattern on the feet, be sure that the grain runs the long way or the foot will not be strong enough.

TOOL HOLDER

F. N. Newton, Jr., Senior High School, Sharon, Pennsylvania

This type of tool holder is very handy for use in the machine shop. When used as a spring tool it is excellent in chasing threads, for it works similar to a gooseneck tool and has a tendency to eliminate chatter. When used for larger threads or for turning, the screw rod can be screwed up against the front part of the holder thus turning the holder into a solid tool holder.

The various parts furnish an excellent project for the drawing room, forge shop, and machine shop.

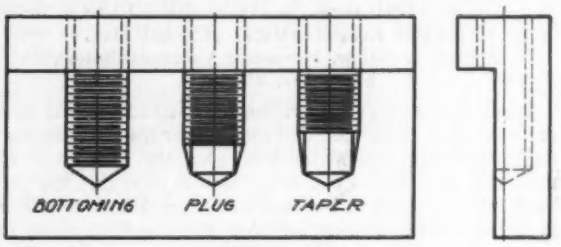
As a machine-shop problem the project embodies cylindrical turning, thread cutting, knurling, chipping, filing, drilling, tapping, hardening, shaper cutting, and polishing.

TAPPED HOLES

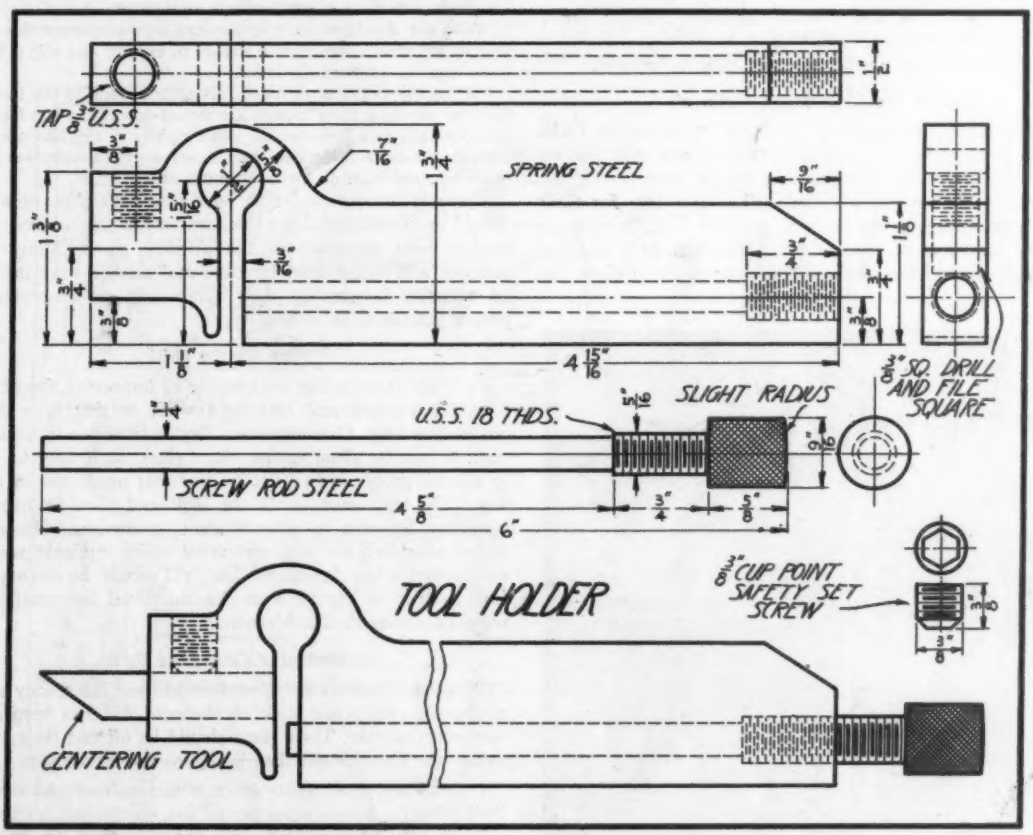
A Teaching Device to Illustrate the Use of a Set of Taps

Rowland L. Hill, Apprenticeship Director, Jackson, Michigan

To more clearly show to the students in machine and gen-



TAPPED HOLES



eral shops, the use and action of a set of taps, the piece shown in the accompanying drawing was made.

The three taps as stamped on the piece of metal, are first inserted into their respective pieces. They should be turned down as far as they will go, and then passed around the class. Each student may then see what happens down inside a hole when it is being tapped, with each of the taps. The point to stress, of course, is that when the end of the tap hits the bottom of the hole, more twisting is likely to break the tap.

The arrangement shows how the taper and plug taps hit the bottom of the holes without cutting full threads to the bottom of the hole. Thus, if threads are desired right to the bottom of the hole a bottoming tap must be used. This last statement should impress on the students why the tap is called a "bottoming tap."

To make the piece, drill and tap the holes as indicated in the drawing, with each of the taps. It is not necessary to tap them the full depth at first. After the part is milled out, it is easy to see just how far each hole is tapped. By not cutting away the metal right down to the center line of the holes, the taps can again be inserted and the holes tapped until the desired amount of threads is cut.

PROPER POSTURE AND CORRECT TECHNIQUE WHEN SETTING TYPE IMPROVED BY DRILL

William J. Patlow, Milwaukee Vocational School, Milwaukee, Wisconsin

When a student in the printing class stands on one foot or is slouched at the case and fumbles for his type and hesitantly places it into his stick without any smoothness of movement, it reminds one of a football team that has not been drilled enough in its signals and line formations. How is it possible for students at West Point and Annapolis to march with such precision of step when on parade? Certainly not by casual demonstration, but by continuous drill until every movement has become habitual. Spelling drills, arithmetic drills, and penmanship drills are still used in order that more accuracy of accomplishment may be secured.

Habits Should be Made Automatic

William James, the noted psychologist states in his *Talks to Teachers* that the more of the details of our daily life we can hand over to the effortless custody of automatism, the more our higher powers of mind will be set free for their own proper work. He continues to say that there is no more miserable human being than one in whom nothing is habitual but indecision, and for whom the lighting of every cigar, the drinking of a glass of water, the time of rising and going to bed every day, and the beginning of every bit of work are subjects of volitional deliberation.

If there is anything that should be made automatic and habitual in the printshop, it is the way the student stands at the case and how he picks up the type and places it into the stick. Many students are hindered because their typesetting habits have not been made automatic. They do not stand at the case in the proper manner. When they pick up the type from the compartment, they grasp any letter and waste time twisting, turning, and examining the type before it is placed into the stick. This can all be remedied by supervised drill. The student will not then have to think about every move that he makes, because through drill these movements become automatic.

Figure 1 shows a student who has assumed the proper posture at the case. Notice that he is standing firmly on two feet with his chin and stomach drawn in. Figure 2 shows the correct position of the left hand and right fingers when setting type. Figure 3 is a close-up of the correct position of the feet when standing at the case and setting type.

Medical Viewpoint of Good Posture

The printing student could well afford to heed the advice of Dr. Barton who writes in the *Milwaukee Journal* as follows about the erect carriage:

"It was my privilege for a number of years to examine the students of a large university and also of some preparatory schools. One of the points we tried to emphasize was the importance of standing correctly, because an erect carriage attained during youth becomes a part of the grown man or woman. What is the effect upon the body of a drooped or slouched position of the shoulders and body? As Goldthwait well says, 'the whole body suffers, the weight is thrown imperfectly upon the feet so that the arches are strained; the knees are slightly sprung. The position of the bones at hips is put at a wrong angle, thus causing a strain of the joints between spine and hip bones. This is the cause of many cases of low back pain often called lumbago and sciatica.

" 'With the shoulders hanging forward in this manner the upper part of the chest doesn't get a chance to expand and this is where most cases of tuberculosis begin.

" 'Then this position allows the abdominal walls to fall forward, thus the organs in the abdomen are forced downward and forward. The stomach and liver cannot work rightly if the ribs are contracted, the loose abdominal organs are crowded downward and the whole nutrition of the body must suffer.' "

There is no question that poor posture at the type case should be eliminated. Its consequences are too serious to the student who continues in the printing trade. Many compositors who suffer from lumbago and sciatica may probably be suffering because of their carelessness in observing the proper posture while setting type.

Time for the Drill

The drill exercise for the purpose of improving the printing student's posture and technique while setting type should not be too long. Five minutes a day is sufficient time for the drill. It can be given to the entire class, or it may be given to a small group, or to an individual that needs special attention. The instructor starts the drill and then he may call upon the foreman or other student to continue. He is thus better able to point out and assist those students who are not following the directions. The drill should be discontinued just as soon as the class or the individual has reached the required standard of achievement.

Method of Giving the Drill

When the students are assembled at their cases, they should all have a composing stick on the case that has been set to the same measure. Their coats should be off and their sleeves rolled up. They should then be instructed as follows:

1. Stand about six inches away from the front and center of your case.
2. Let your hands hang at your hips.

3. Place your heels fairly close together and distribute your weight evenly on both of your feet. The feet should be at a comfortable angle (about 60 degrees).

4. Throw out your chest, draw in your stomach and pull in your chin.

5. Place the composing stick, with the right hand, into the palm of the left hand.

6. Put the left thumb inside of the stick and hold the tips of the fingers on the side of the back plate.

7. Hold the left arm at about a 45-degree angle in front of and across your chest with the elbow hanging in a natural position. Do not rest the left hand on the case.

8. Spot a letter on the top of the pile in the *a* compartment. Note the position of the face and nick of the letter.

*9. At the count of one, grasp the type that you have spotted by the face with the nick turned as it will be when it is placed into the stick. Do not grasp the type by the feet.

10. At the count of two, place the type without looking at it into the lower left corner of the stick and hold it in place with your left thumb.

11. Repeat these operations at the count of one, two; one, two; etc., until the line is filled. (The rate of speed when counting should be considered. It is a good plan to start counting very slowly at the beginning of the drill and then to increase the speed of counting after the students have become used to it. Student interest in the drill can be developed by giving different students a chance to count as they are taking part in the drill.)

12. Examine the line for wrong-font letters and other mistakes. You can save your eyes by waiting to read the type after the line has been filled.

13. Make corrections and insert more letters to fill the line.

14. After this has been done, start a new line at the count of one, two; one, two; etc., and fill another line.

15. Examine this line also, make corrections and fill the line.

The instructions given may be repeated until the stick has been filled. The type is then to be placed back into the compartment from which it was taken.

Summary

In conclusion, it may be said that the drill will result in the following beneficial results when the students set type at the case:

1. Better appearance while at the case.
2. Less fatigue at the end of the class period.
3. Stick will be held in the proper manner.
4. Fingers become better trained to grasp the type properly.
5. Type will be placed into the stick with less effort and greater speed.
6. Left thumb will be used to hold the last letter in the line, thus preventing the line from piing.
7. Type letters will be read after the line has been filled and in this way conserve the eyesight and the time of the student.
8. Typesetting becomes a pleasure instead of a drudgery when proper posture and correct technique habits are automatic.

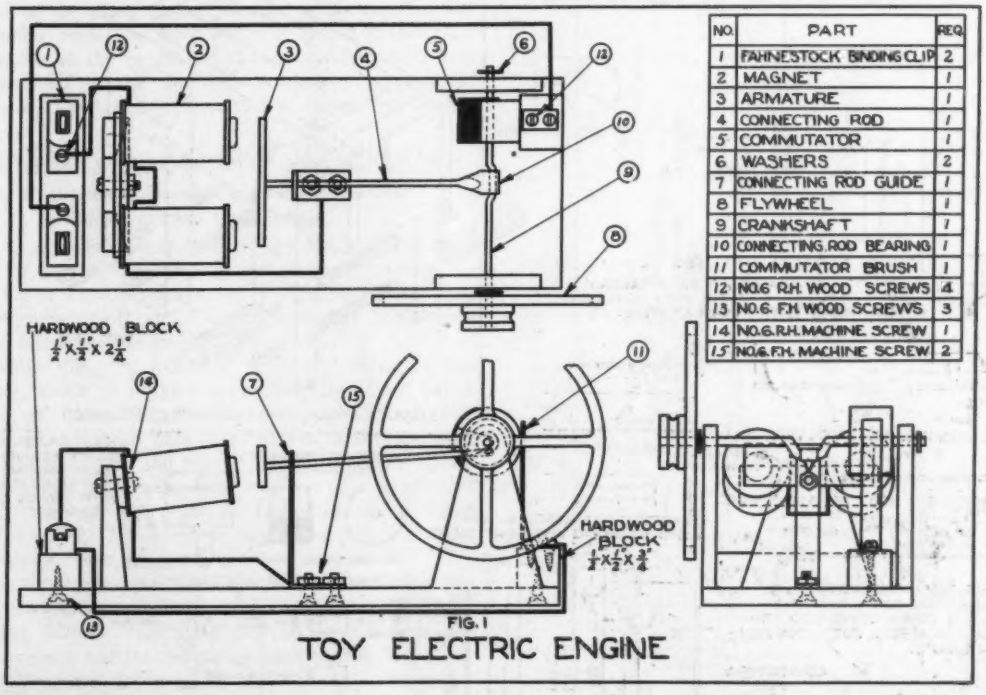
AN ELECTRIC ENGINE

E. A. Rerucha, Wakefield, Michigan

Boys are always interested in making things, and more so in making things that run. However, a project should not only cater to the boy's interest but should also serve an instructional or educational purpose. The electric engine described in this article has been used by the writer as a project for eighth-grade boys in elementary electricity with satisfying results. It is attempted as a final project of the course after the class has covered work giving instruction and experience with electric circuits, electromagnets, and the elements of electricity in general. It serves as a practical application of these principles. An assembly drawing of the engine is shown in Figure 1.

The Flywheel and Engine Form

In its first form the engine frame was constructed entirely of wood. The frame and flywheel of the engine described herewith, however, is cast in lead. The boys bring odds and ends of lead, which they pick up about the home, and this is melted. The castings are then poured in a hardwood form, which is made in three parts. It may be made of one block of wood and then sawed as indicated in Figure 2. Allowance should be made for the material removed by the saw when sawing. The cavity for the tapered magnet support is obtained by first sawing a slot across the entire width of the form and then blocking the ends with the blocks shown at A in Figure 2. Two rectangular pieces with over-all dimensions equal to those of the form and at least ⅜ in. thick are



NO.	PART	REQ.
1	FAHNESTOCK BINDING CLIP	2
2	MAGNET	1
3	ARMATURE	1
4	CONNECTING ROD	1
5	COMMUTATOR	1
6	WASHERS	2
7	CONNECTING ROD GUIDE	1
8	FLYWHEEL	1
9	CRANKSHAFT	1
10	CONNECTING ROD BEARING	1
11	COMMUTATOR BRUSH	1
12	NO.6 R.H. WOOD SCREWS	4
13	NO.6 F.H. WOOD SCREWS	3
14	NO.6 R.H. MACHINE SCREW	1
15	NO.6 F.H. MACHINE SCREW	2

FIG. 1
TOY ELECTRIC ENGINE

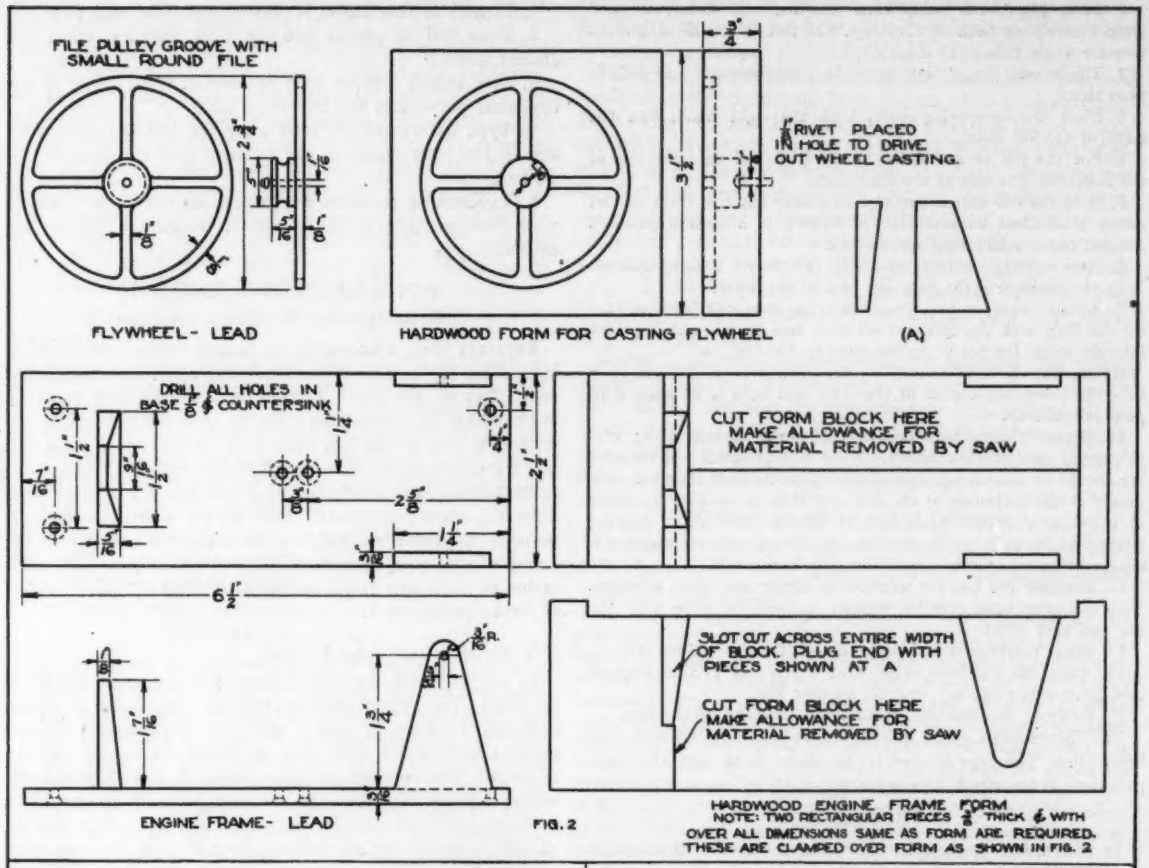

FILE PULLEY GROOVE WITH SMALL ROUND FILE
FLYWHEEL - LEAD
HARDWOOD FORM FOR CASTING FLYWHEEL
RIVET PLACED IN HOLE TO DRIVE OUT WHEEL CASTING.
(A)
DRILL ALL HOLES IN BASE FOR & COUNTERSINK
ENGINE FRAME - LEAD
CUT FORM BLOCK HERE MAKE ALLOWANCE FOR MATERIAL REMOVED BY SAW
SLOT CUT ACROSS ENTIRE WIDTH OF BLOCK. PLUG END WITH PIECES SHOWN AT A
CUT FORM BLOCK HERE MAKE ALLOWANCE FOR MATERIAL REMOVED BY SAW
HARDWOOD ENGINE FRAME FORM
NOTE: TWO RECTANGULAR PIECES THICK & WITH OVER ALL DIMENSIONS SAME AS FORM ARE REQUIRED. THESE ARE CLAMPED OVER FORM AS SHOWN IN FIG. 2

FIG. 2

ELECTRIC ENGINE DETAILS

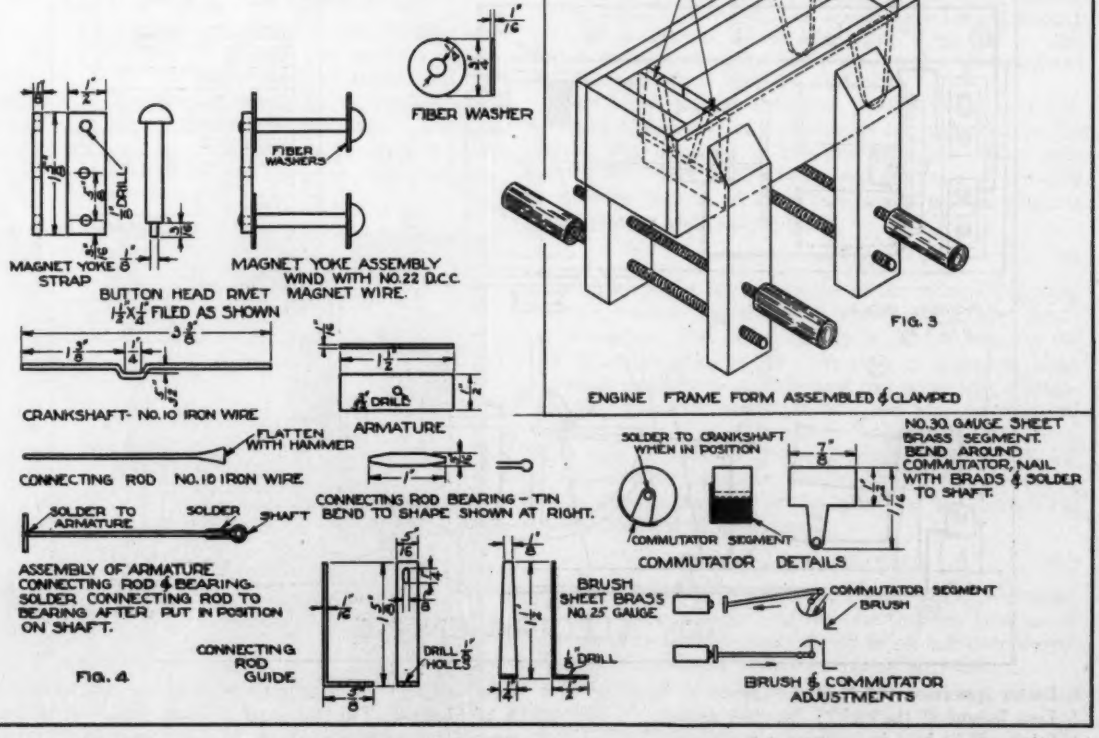

FIBER WASHER
FIBER WASHERS
DRILL
MAGNET YOKE STRAP
MAGNET YOKE ASSEMBLY WIND WITH NO.22 D.C.C. MAGNET WIRE.
BUTTON HEAD RIVET FILED AS SHOWN
CRANKSHAFT - NO.10 IRON WIRE
ARMATURE
FLATTEN WITH HAMMER
CONNECTING ROD NO.18 IRON WIRE
CONNECTING ROD BEARING - TIN BEND TO SHAPE SHOWN AT RIGHT.
SOLDER TO ARMATURE
SOLDER
SHAFT
ASSEMBLY OF ARMATURE CONNECTING ROD & BEARING. SOLDER CONNECTING ROD TO BEARING AFTER PUT IN POSITION ON SHAFT.
CONNECTING ROD GUIDE
DRILL HOLES
SEE (A) FIG. 2
ENGINE FRAME FORM ASSEMBLED & CLAMPED
SOLDER TO CRANKSHAFT WHEN IN POSITION
COMMUTATOR SEGMENT
NO.30 GAUGE SHEET BRASS SEGMENT. BEND AROUND COMMUTATOR, NAIL WITH BRADS & SOLDER TO SHAFT.
COMMUTATOR DETAILS
BRUSH SHEET BRASS NO.25 GAUGE
COMMUTATOR SEGMENT
BRUSH
DRILL
BRUSH & COMMUTATOR ADJUSTMENTS

FIG. 4

FIG. 3

clamped on each side of the form as shown in Figure 3. The form may be clamped in a vise, or between clamps, and the lead poured. When the lead cools, which takes but a short time, the casting is removed by taking the form apart and any rough edges are removed with an old file or rasp. The writer keeps several old files and rasps handy for this purpose. The form for the flywheel is self-explanatory. The rivet is placed in the form before the lead is poured and is used to help drive the casting out of the form.

The Electromagnet

The magnet frame is made up as shown in Figure 4. The fiber washers are cut out of sheet fiber with hollow punches. The cores are wound evenly with No. 22 d.c.c. magnet wire. A covering of stiff paper is placed over the winding for protection.

Crankshaft, Commutator, and Armature

The details of the crankshaft, commutator and brush, connecting rod and armature also are shown in Figure 4. The connecting rod should first be soldered to the armature. The piece of tin which constitutes the connecting-rod bearing is bent in position and the flat end of the connecting rod inserted and soldered in place. The rod should be adjusted so that the armature does not hit the magnet when the crank is in position nearest to magnet.

The Commutator Adjustment

The commutator adjustment is shown in Figure 4. When the crank is in the first position shown, and the armature is traveling toward the magnet, the circuit should be closed by the brush and commutator segment so that the electromagnet is energized. When the crank is in the second position and the armature is ready to travel from the magnet the circuit should be broken by the commutator so that the attraction of the magnet ceases and is not repeated until the crank is again in the first position.

The Connections

One end of the electromagnet winding is connected to one of the binding clips. The other end is grounded to the frame of the engine at the connecting-rod guide, the circuit now being completed to the commutator segment through the engine frame. The brush is connected to the second binding clip.

ORGANIZED WOODSHOP PROCEDURE

B. W. Schneider, Director of Manual Training,
Belle Fourche, South Dakota

The instructor frequently inherits the job of doing tasks forgotten or haphazardly done by the students; namely, arranging clamps, closing vises, cleaning brushes, repiling lumber, putting away tools, etc. This becomes very burdensome where one handles a hundred students a day.

To obviate this, the following system of monitors was worked out, and it is working very efficiently. Each boy is sincere in his responsibility and eager to do his task well. The monitors clean their desks ten minutes earlier, and then supervise the closing of the period. The boys report untidiness to the instructor, confidentially, and one point is removed from their final six-weeks mark for each shop offense which they do not report. The monitors serve for a period of three weeks, when new ones are appointed.

The checkers merely notify the students of an existing condition but do not demand a correction; this is implied. If the student then fails to make the correction he is reported on that day's report, and the instructor takes charge.

The positions and duties are:

Desk checker: Is vise closed? Is desk top brushed? Are tools in place? Project properly put away?

Machine-room caretaker: Brushes and dusts all machines. Oils machines. Reports anything out of order.

Finishing-room caretaker: Inspects all containers and brushes. Reports any untidiness. Arranges storage cabinet.

Lumber-rack and exhibit caretaker: Piles lumber. Dusts and arranges exhibits.

General tool-cabinet caretaker: Reports all unreturned tools. Inspects tools for breakage and misuse.

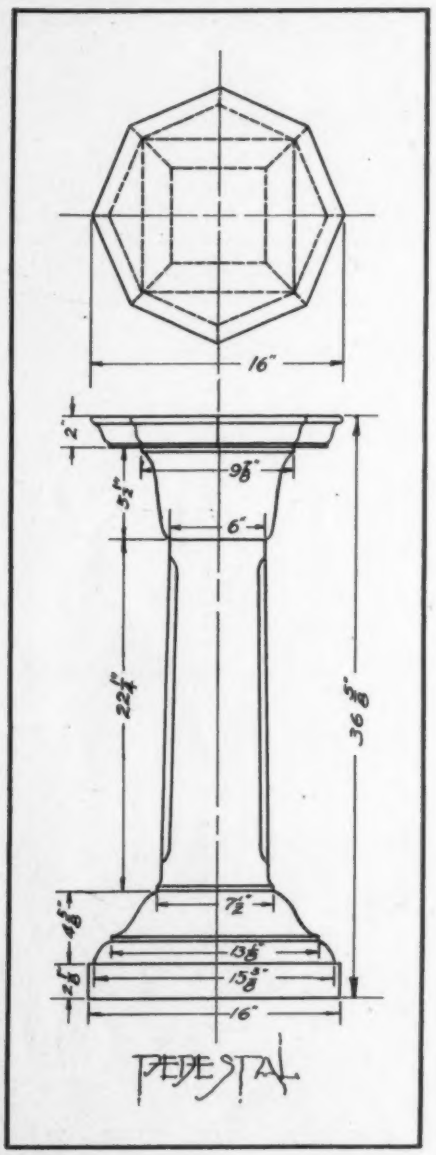
General workbench caretaker: Cleans miter saw. Arranges clamps. Cleans whetstones. Brushes bench top.

In 12 weeks I have had but 6 high-school and 12 junior-high-school students reported, which is ample proof that the boys have received this system with the proper attitude. The system utilizes 6 of the 24 boys—the remaining 18 sit at their desk until all the checkers have finished their assigned tasks, and not until then is the class dismissed. The boys are enthusiastic about assuming this responsibility. It also makes them more appreciative of shop conditions, and they develop pride in the appearance of the shop.

PEDESTAL

C. A. Palmer, Wasatch Academy, Mt. Pleasant, Utah

The concrete pedestal in the accompanying illustration shows an attractive problem in concrete casting. It may be used on the school campus or in the home garden.



The pedestal is cast in four sections which are later assembled and held together by metal dowels and cement. The top section may either be cast flat to take a sundial or be hollowed for use as a bird bath. The hollowing is done by using a clay core in the form.

Forms for pedestals of this kind may be purchased or moldings may be secured from the lumber dealer and altered to suit the different angles at which they are used. The inside of the forms must be sanded smooth, given several coats of shellac, and well oiled. They should be fastened together with screws whenever possible.

Patching and smoothing may be done when the concrete has cured and the forms are removed. Surface decoration may be applied or worked into the casting as desired.

COLONIAL TIP TABLE

Richard Shaver, High School, Saranac Lake, New York

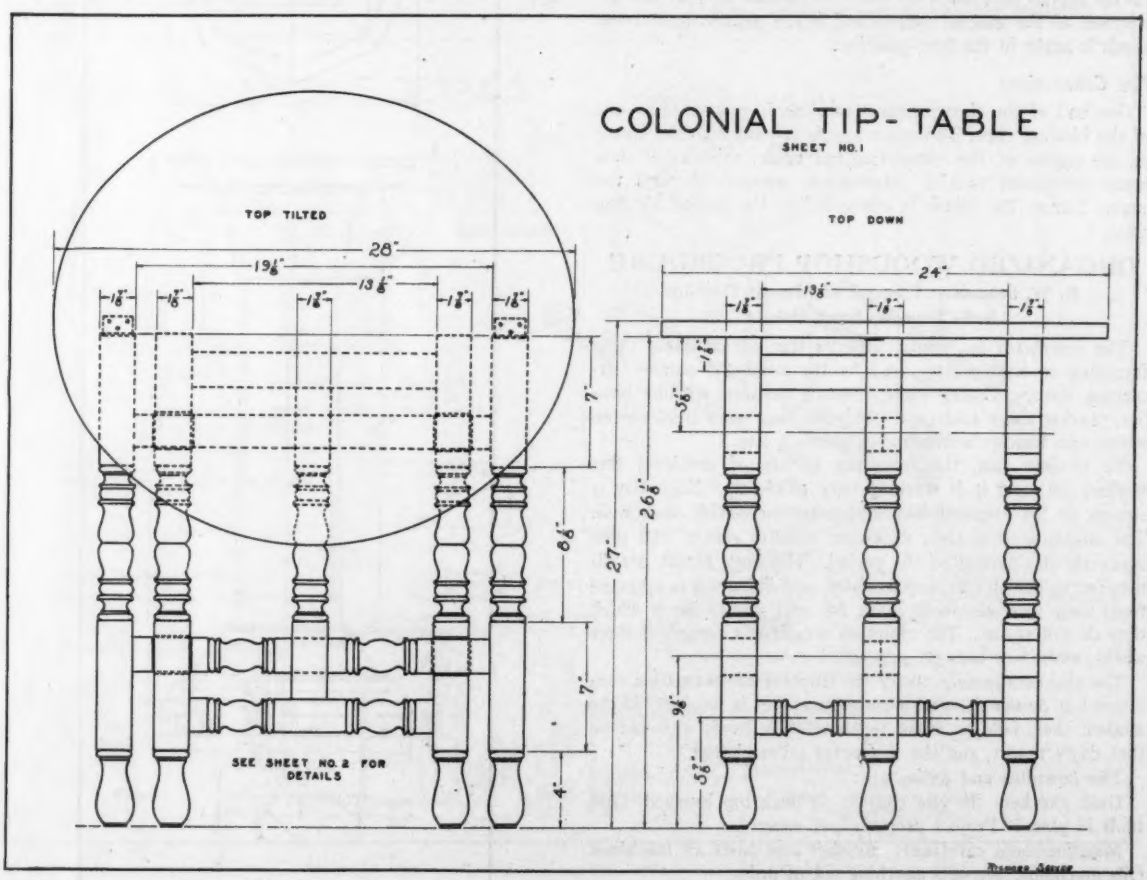
The Colonial tip table has the unique and convenient feature of folding up so that it will fit in a very narrow space when not in use. The top, which is hinged, tips up and the gate swings back into line with other legs, and so the overall thickness when folded is equal to the thickness of the legs plus the thickness of the top. This folding feature requires careful layout of the mortises and half-lap joints, but if the dimensions given are carefully followed, no trouble should be encountered. As the table is of Colonial origin, it is particularly appropriate when built of maple, although either mahogany or walnut will look well. A nicely figured piece of panel should be selected for the top.

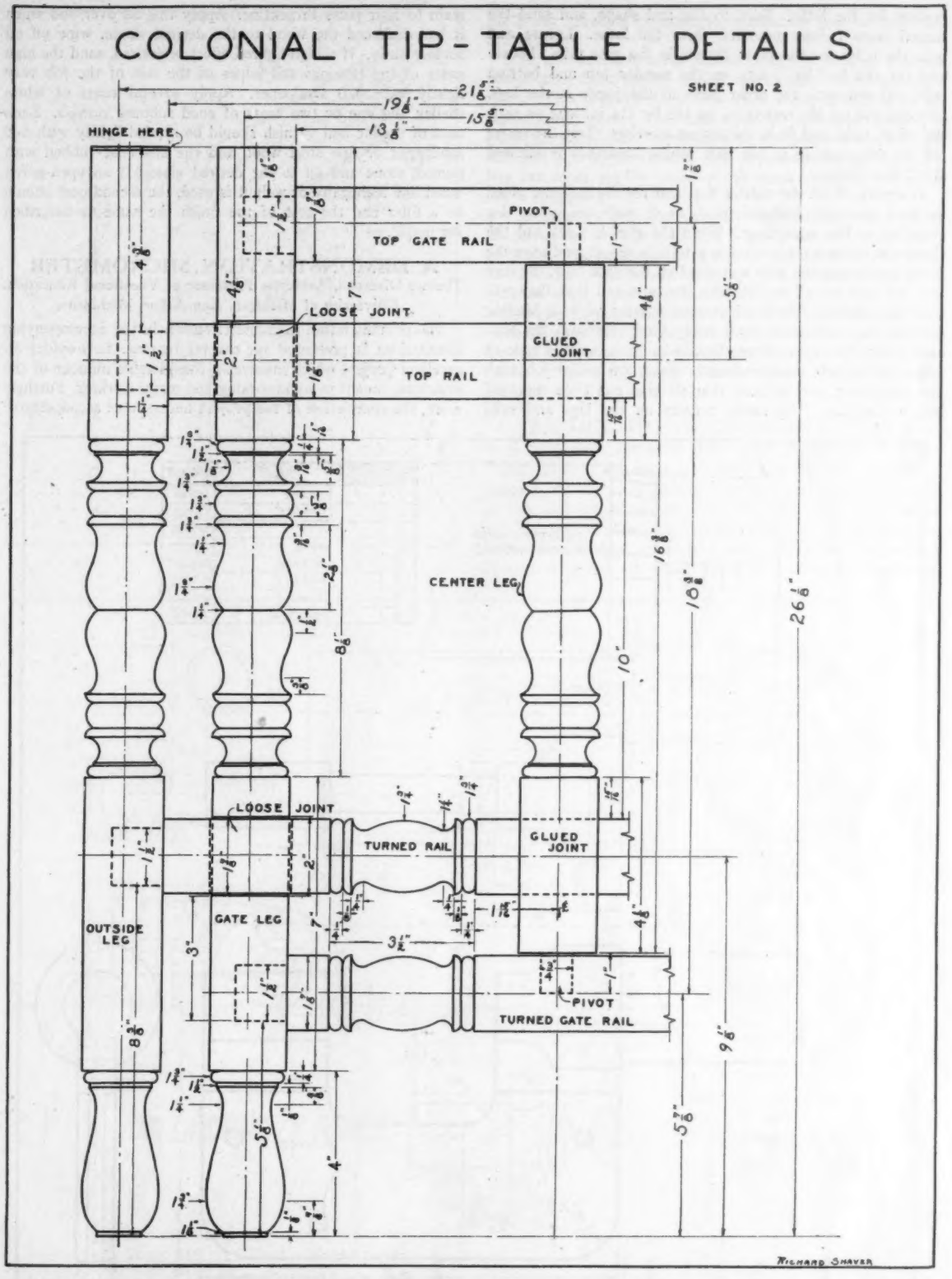
Directions

Top. The top should be made of $^{13}/_{16}$- or $^{7}/_{8}$-in. panel with a nicely matched face veneer. Lay out an ellipse 24 by 28 in. on the underside and bandsaw out. Sand the edges rounding the corners slightly. Be sure to select stock for this part which has neither warp nor wind, as there is nothing in the construction of the table which will tend to hold it flat.

COLONIAL TIP TABLE

Legs. Select and square up four pieces, $1^{7}/_{8}$ by $1^{7}/_{8}$ by $26^{1}/_{8}$ in. and one piece $1^{7}/_{8}$ by $1^{7}/_{8}$ by $18^{3}/_{8}$ in. Square lines around the sticks to limit the parts to be turned, and locate the lathe centers. Turn to size and match, then sand the turned parts before removing from the lathe. The pivot dowels on the cen-





ter legs must be turned exactly to size and care must be taken to keep the correct distance between the dowels. Lay out the mortises, ½ by 1½ by 1¼ in. deep in the outside and gate legs, for the joints with the rails, and check carefully before cutting. Lay out and cut the loose half-lap joints in the gate legs and the tight half-lap joints in the center leg. Sand the flat parts, being careful not to round the corners over or they will make poor joints with the rails which are the same thickness.

Rails. Select and square up two pieces, 1⅞ by 1⅞ by 21⅝ in. and two pieces, 1⅞ by 1⅞ by 15⅝ in. Square lines around the turned parts of the bottom rails and locate the

centers for the lathe. Turn to size and shape, and sand the turned parts before removing from the lathe. Locate and bore the holes for the pivot dowels in the gate rails. Locate and cut the half-lap joints on the regular top and bottom rails and test with the other parts of the joints in the legs. Lay out and cut the tenons ½ by 1½ by 1¼ in. long on each end of all rails, and fit in the proper mortises. Test the entire job by clamping up to see that proper clearance is allowed at all loose joints.

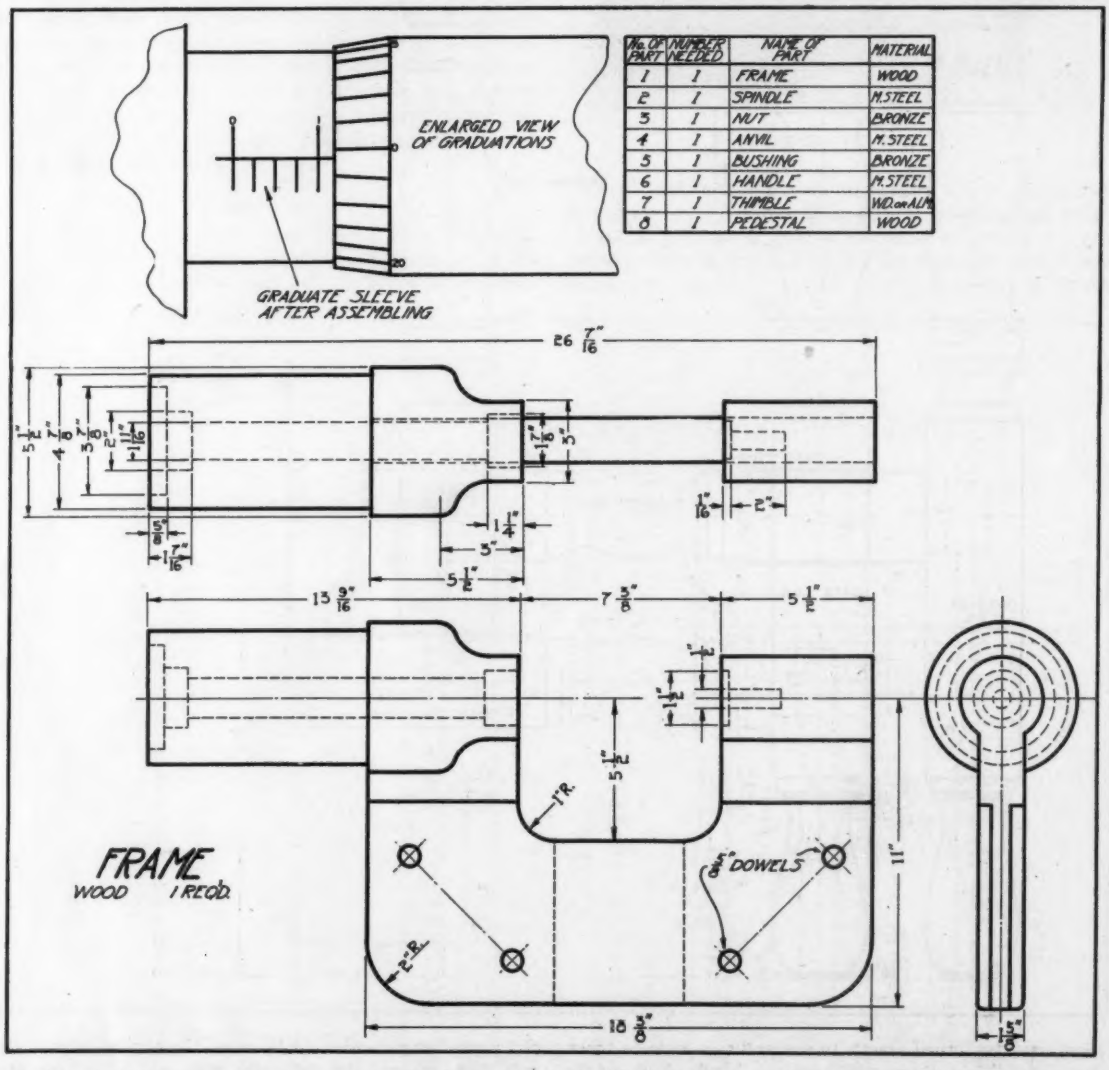
Assembly. First the outside legs and regular rails are glued up with the tight half-lap joints made with the center leg glued up at the same time. When the glue has set and the clamps have been removed, the gate rails are slipped over the pivot dowels and the gate legs glued on the gate rails. Be sure that the legs are all square with the rails and that they will fold up properly. These joints must operate without binding now, or they will never work freely after the finish has lessened their clearance. Hinge the top in place, using a pair of 1¾-in. wide butt mortise hinges. Sand the entire job with fine sandpaper, and be sure that all glue has been removed before finishing. The sharp corners on the legs and rails should be rounded over at this time, and chair glides may be driven into the legs to make it slide easier.

Finishing. If an antique finish on maple is desired, thin out a little walnut oil stain with turpentine in a ratio of one part stain to four parts turpentine. Apply this all over and when it has darkened the wood to the desired shade, wipe off all surface stain. If a high-lighted effect is desired, sand the high parts of the turnings and edges of the rest of the job very lightly with 6/0 sandpaper. Apply several coats of white shellac and one or two coats of good rubbing varnish. Each coat of shellac and varnish should be sanded lightly with 6/0 sandpaper or fine steel wool, and the last coat rubbed with pumice stone and oil to the desired gloss. If an open-pored wood like mahogany or walnut is used, the second coat should be a filler and the rest of the finish the same as described for maple.

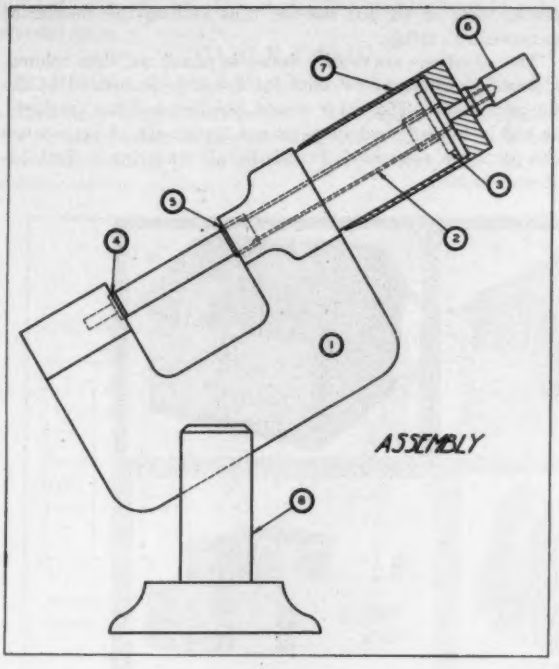
A DEMONSTRATION MICROMETER

Thomas Diamond, Associate Professor of Vocational Education, University of Michigan, Ann Arbor, Michigan

The demonstration micrometer shown in the accompanying illustrations is presented for several reasons. It provides an excellent project which involves a considerable number of the principles taught in woodworking and metal working. Furthermore, the completion of the project necessitates a coöperative effort between the woodworking and metal-working departments. Another reason for considering it as a shop community project is that, when it is completed, the finished article will be of immense value to the individual who has the responsi-



No. OF PART	NUMBER NEEDED	NAME OF PART	MATERIAL
1	1	FRAME	WOOD
2	1	SPINDLE	M. STEEL
3	1	NUT	BRONZE
4	1	ANVIL	M. STEEL
5	1	BUSHING	BRONZE
6	1	HANDLE	M. STEEL
7	1	THIMBLE	WD. or ALM.
8	1	PEDESTAL	WOOD



bility for teaching prospective machinists how to read the micrometer.

It is not uncommon for human beings to look at a rather complicated thing and be unable to see what the object actually is. This is particularly true when a boy is invited to examine a micrometer. He looks at it but he is quite unable to grasp the significance of the minute divisions shown. With an enlarged type of micrometer, such as is described herewith, the boy can more readily observe the result obtained when the sleeve is turned.

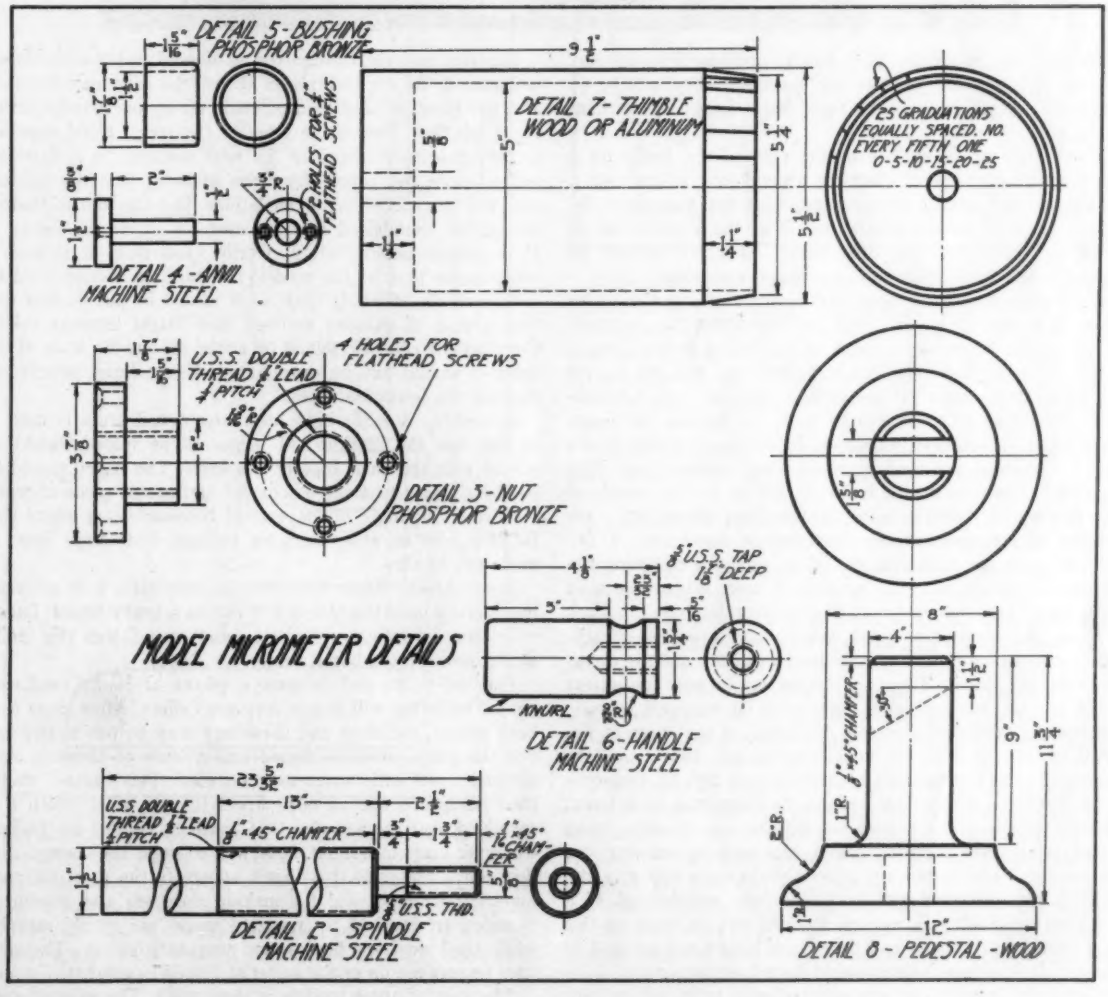
The drawings were made from a demonstration micrometer which has been in use in the Ford Trade School for a number of years. The original was designed and made by the boys in the Ford Trade School and they have produced a piece of work of which they may be proud.

It should be pointed out that although some of the parts are made of wood it might be profitable in some cases to redesign the tool and make the wooden parts of aluminum. This is particularly true of the sleeve which is quite a delicate job when made of wood.

MODEL HOME CONSTRUCTION

R. E. Cote, Boys' Technical High School, Milwaukee, Wisconsin

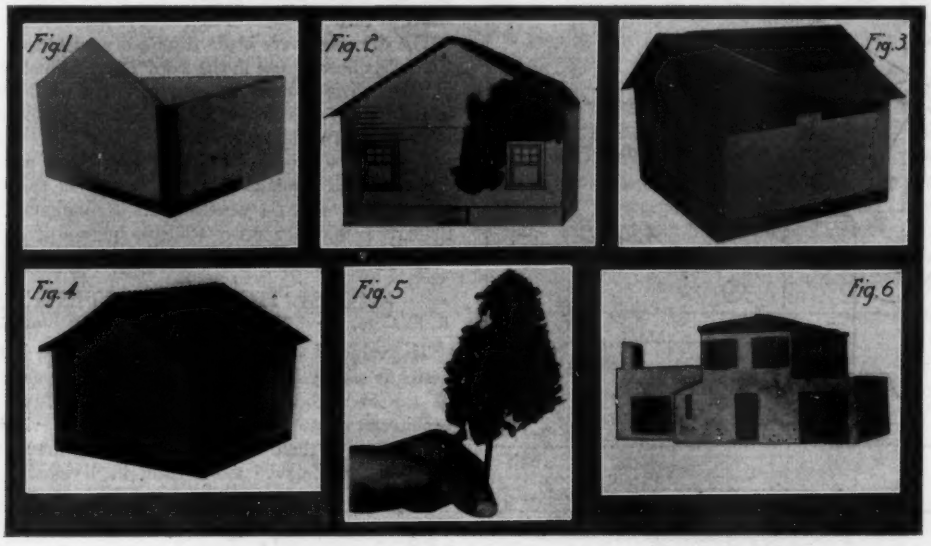
The value of architectural models as an aid in the study of design is readily accepted, but it has a bigger objective insofar as the high-school student is concerned. Most high-school architectural students are rather weak in visualizing their house plans in three dimensions, hence the actual construction of such a model will assist them in developing this power.


DETAIL 5 - BUSHING PHOSPHOR BRONZE
DETAIL 7 - THIMBLE WOOD OR ALUMINUM
25 GRADUATIONS EQUALLY SPACED. NO. EVERY FIFTH ONE 0-5-10-15-20-25
2 HOLES FOR FLATHEAD SCREWS
DETAIL 4 - ANVIL MACHINE STEEL
U.S.S. DOUBLE THREAD 1/2 LEAD 1/4 PITCH
4 HOLES FOR FLATHEAD SCREWS
DETAIL 3 - NUT PHOSPHOR BRONZE
MODEL MICROMETER DETAILS
KNURL
DETAIL 6 - HANDLE MACHINE STEEL
U.S.S. DOUBLE THREAD 1/2 LEAD 1/4 PITCH
DETAIL 2 - SPINDLE MACHINE STEEL
DETAIL 8 - PEDESTAL - WOOD

In addition, habits of accuracy, patience, and neatness are developed.

The model illustrated herewith shows a construction which is sturdy enough to permit considerable handling without fear of breakage. The materials listed with trade names are not necessarily the only ones that may be used. Those mentioned merely represent the author's preference.

The plans for the model must be drawn first. A scale of ¼ in. to the foot is desirable, as it usually provides a model that is large enough, and permits the thorough development of details. Besides this, it is the usual scale found on working drawings.



Plan. Draw up an outline of the plan of the house on a piece of wall board first. Then cut around this outline with a coping saw and smooth up the edges with fine sandpaper. Be sure to keep all corners squared up, using the T square at all times. In estimating the dimensions, allowance should be made for the thickness of the cardboard elevations.

Elevations. Any fairly rigid cardboard will do for the elevations. It is usually 1/16 in. thick, so allowances can be made on this basis. Now take a sheet of cardboard and lay out a profile of each elevation. The elevations are *not* cut in one piece and then creased at the corners, but they are cut individually. Allowance must also be made for butting the pieces together at the corners, as shown in Figure 1, which shows how the corners are held in place with binding tape. This tape should be used on the inside as well as on the outside of the corners. All details such as windows, doors, etc., are omitted from these cardboard elevations.

Small nails and cold glue should be used for fastening the cardboard elevations to the wall-board base. When this is all completed, the result will look like an irregular box.

Now take a sheet of good white drawing paper—Strathmore 3-ply bristol board is very good—and lay out the elevations in full detail. They are drawn up in one continuous piece so that when finished they may be wrapped entirely around the cardboard skeleton. However, if the paper is too small to take them in one continuous length, they should be drawn up in as few sections as possible (see Fig. 2). Generous flaps should be allowed for pasting. Stixmore has been found to hold very well and it does not dry out too quickly. Prang water colors and tempera paints are used in coloring the elevations. These paints are reasonable in price and give the desired hues, whether dull or bright ones are desired. If a brick or stone effect is wanted, Reliefo may be used, as this clay comes in all colors and dries very hard when exposed to the air. It is a form of gesso sold by art dealers.

Generally, projections are satisfactorily indicated by rendering them on the flat surface, thus limiting the amount of unnecessary cutting.

The elevations are usually drawn in pencil and then colored. Colored pencils may be used for detail work instead of the tempera colors. The color should not be used too sparingly, as highly colored renderings do not appear out of place when the parts are assembled. Practically all rendering is done before assembling.

The roof may be constructed in several ways, as is shown in Figure 3. As the illustration shows, the roof may be made of a flat piece of cardboard or made up of long narrow strips glued together. Personally I prefer the strips glued together as they give more depth to the roof shadows. It is fastened down before the paper elevations in order that the binding tape will be covered by the elevations. If a tile roof is desired, corrugated strawboard may be used, as shown in Figure 4. It is usually painted after erection, and since it is such a conspicuous part of the model, the painting should be done very carefully. A fairly dark wash should be put on first and then groups of shingles outlined with bright tempera colors. Considerable contrast should be aimed at, but the scale of the shingles should not be exaggerated. Use colored pencils for drawing the horizontal lines.

Assembly. A razor blade or sharp stencil knife is used in cutting out the sections. All edges to be folded should be scored with the back edge of the knife. The paper should be pasted all over to make a stronger and neater piece of work.

Dormers, railings, blinds, and all accessories are added last. Binding wire may be used for railings, and lamps may be made out of clay.

Landscaping. After the house is completed, it is set aside temporarily until the plot is laid out on a heavy board. Locate all walks, driveways, trees, etc., and then fasten the model house down on the board firmly.

For the walks and driveways, pieces of 1/16-in. cardboard coated with clay will give a very good effect. After these have been placed, the trees and shrubbery may be put in position. For the grass, sawdust dipped into a bath of tempera color thinned down with water may be used. This "grass" should then be spread out on newspapers to dry, after which it is sprinkled over the wet glue that has been applied on the base wherever grass is wanted. It is well to press the colored sawdust down gently so that it will adhere to the base. Different materials may be used for making the trees and shrubbery. Sponges, trimmed to the required shape, are an old standby, while steel wool has been found very satisfactory. The color may be sprayed on or the material dipped in color.

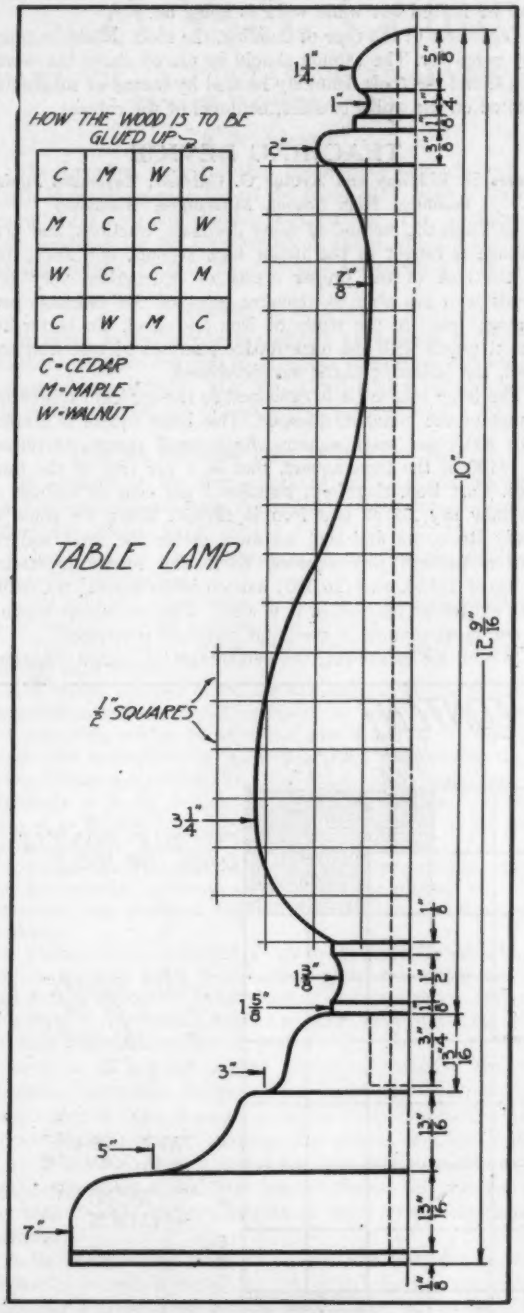
The cost of these models is very small. The average costs

approximately $6, of which the largest amount is for a substantial base.

TABLE LAMP

H. H. Grauman, Senior High School, Pine Bluff, Arkansas

The table lamp shown herewith was designed as a project for advanced students in woodwork. All instructors in woodwork find it hard to use up their scrap lumber. Here is one solution to the problem.

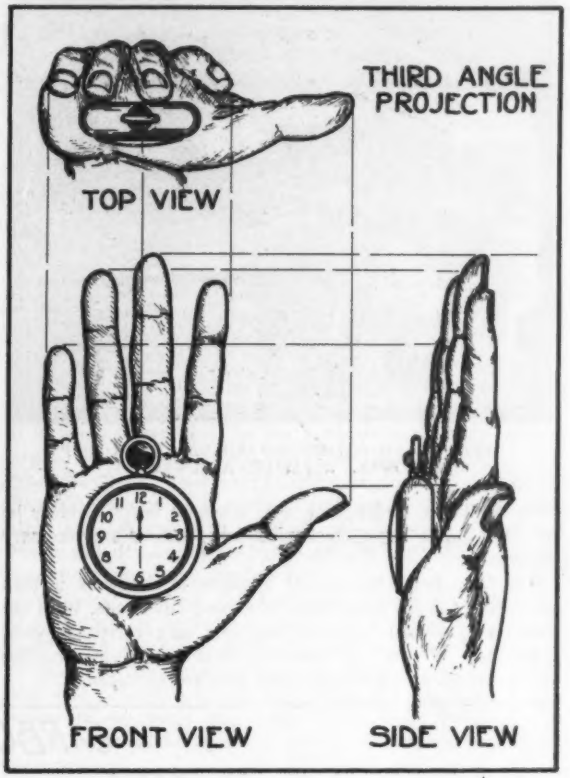


The lamp shown was made of scrap pieces of cedar, maple and walnut, 1 in. square and about 10 in. long. They must be glued together in the manner shown in the drawing, care being taken to match up the woods. Many beautiful designs have been worked out in the turning of these lamps. In finishing these lamps we have found it best to use a natural finish or a French polish.

TEACHING PROJECTION

Chas. Edw. Barker, Balboa High School, San Francisco, California

Two of the most difficult points in teaching mechanical drawing are first to get the object drawn revolved in the correct way, and second, to have views in proper relationship to each other.



The things necessary for teaching this important lesson the pupil usually has; namely, his right hand and a watch.

He places the watch in his hand in the correct position for reading. This represents the front view. He can only move his hand in one direction in that plane and that determines the side view. Looking at the top of his fingers is the top view.

This simple method, once taught, is never forgotten, and I have found it very effective in use.

THE HOME SHOP ON THE FARM

M. F. Thurmond, A. and M. College, College Station, Texas

The home shop affords a place in which many repair jobs may be done on the farm. Construction and repairwork is considered a part of the farmer's problem. He meets daily, dozens of mechanical jobs that cannot be done without a shop.

Farming requires a certain amount of farm machinery, and a certain amount of the earnings from the farm must be put either into new parts for machinery or new machines purchased.

The farmer in almost every case finds it much more economical to purchase new parts or make them in the shop than to purchase a new machine. Much time has been lost by farmers in the busy season because he had to take his machine, or some part of it, to town.

There is nothing that will tend to keep a boy better satisfied on the farm than to give him a well-equipped shop in which he may work on rainy days. In his younger days he will learn to use the tools by making small articles, such as toy wind-

UPPER. FARM MACHINERY AROUND A FARM SHOP
LOWER. REPAIRING A MOWER

mills, airplanes, bird houses, etc. When he becomes older he will take up the larger mechanical jobs, such as are necessary in farming.

The farm boy who receives a course in shopwork in high school can use his home shop to a good advantage. With the supervision of the instructor the boy may carry out good home-shop jobs such as brooders, feeders, watering troughs, and so on. Other good home-shop jobs are as follows:

Concrete feeding floor; sidewalk; harness repair; repairing a pump; portable hog house; poultry feeder; hayrack; stock-loading chute; new wagon tongue; doubletree; hen nests; ladder; sawhorse; neck yoke; tool chest; nail box; wash bench; tool sharpening; overhauling car; and overhauling machinery.

The home shop does not necessarily need to be a fine building. It may be a separate building, one end of a machine shed or the end of the garage. In case the garage is used, the car may be moved out while work is going on.

Regardless of the type of building, the tools should be properly cared for. The cabinet should be placed above the workbench, and the tools definitely located by means of silhouettes painted on the walls, or sides, or doors of the cabinet.

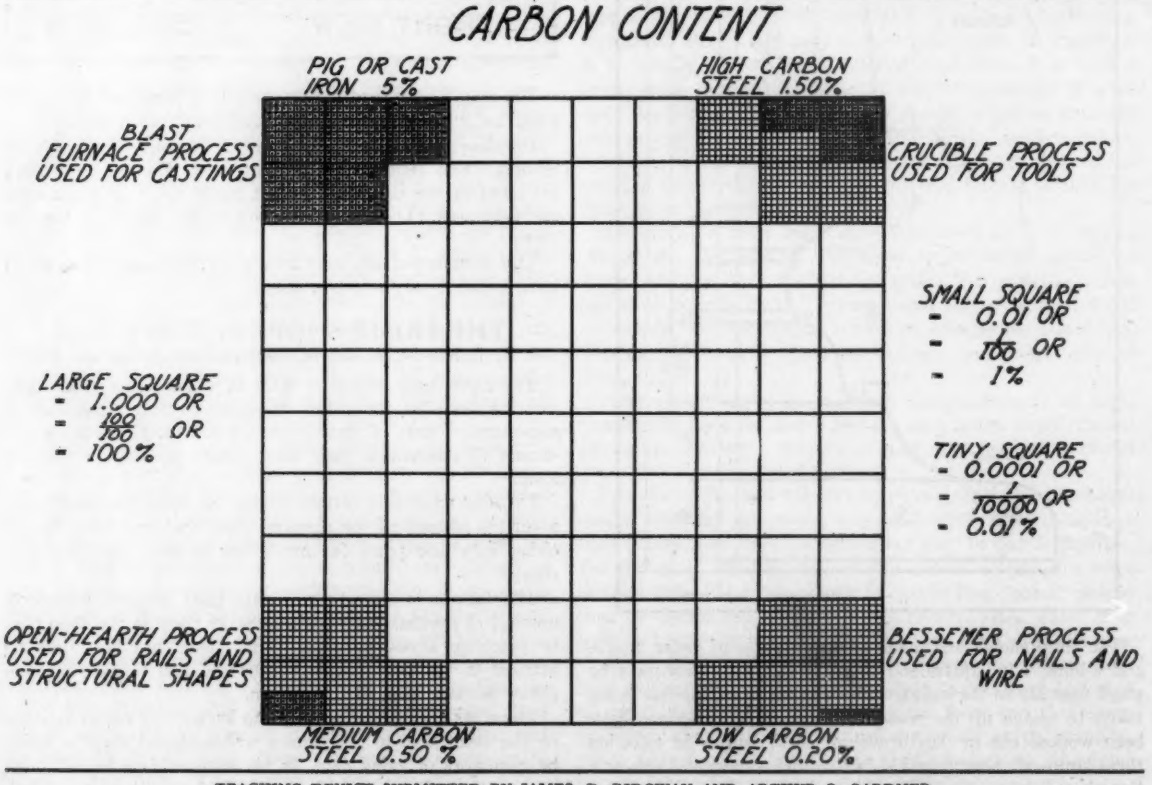
TEACHING DEVICE

James D. Ridgway and Arthur O. Gardner, Kosciusko Junior Technical High School, Milwaukee, Wisconsin

Although the method of using decimals, fractions, and percentage is taught in the junior high schools, one finds, due to the lack of the proper media of instruction, very few pupils who are able to visualize most of the common percentages used in the study of iron and steel. To better acquaint pupils with the quantitative analyses of cast iron and steel, the following chart was developed.

The large square (it is explained to the student) represents a unit of the metal in question. This large square is divided into 100 equal small squares. Each small square, therefore, is 1/100 of the large square, that is, 1 per cent of the total area. Cast iron, therefore, contains 5 per cent of carbon, or we may say .05 of cast iron is carbon. When we come to study steels, we find that we must divide the small squares into a hundred tiny squares. Each tiny square represents 1/100 of 1/100, or, 1/10,000; written in decimals it is 0.0001; and written as percentage it is .01%. The percentage method is one most commonly used and therefore is stressed.

In addition to showing the percentages of carbon contained


CARBON CONTENT
PIG OR CAST IRON 5%
HIGH CARBON STEEL 1.50%
BLAST FURNACE PROCESS USED FOR CASTINGS
CRUCIBLE PROCESS USED FOR TOOLS
SMALL SQUARE - 0.01 OR - 1/100 OR - 1%
LARGE SQUARE - 1.000 OR - 100/100 OR - 100%
TINY SQUARE - 0.0001 OR - 1/10000 OR - 0.01%
OPEN-HEARTH PROCESS USED FOR RAILS AND STRUCTURAL SHAPES
BESSEMER PROCESS USED FOR NAILS AND WIRE
MEDIUM CARBON STEEL 0.50 %
LOW CARBON STEEL 0.20%

TEACHING DEVICE SUBMITTED BY JAMES D. RIDGWAY AND ARTHUR O. GARDNER

in the metals listed, the chart also gives the method by which these metals are produced, and states some of the principal uses of each metal.

Before starting a study of the processes used in the manufacture of iron and steel, and the carbon content of each metal, it might be well to have the student study this chart. The subject then becomes better fixed because of the visual value of the chart.

A Coöperative Study Fostered by the A.V.A. Committee on Standards

PART VII—A TENTATIVE ANALYSIS OF HOME MECHANICS

R. W. Selvidge*

The complete plan for this coöperative analysis was set forth in detail on page 189 of the May, 1931, issue of INDUSTRIAL ARTS AND VOCATIONAL EDUCATION. The summary is here repeated for the information of those who did not have an opportunity to read the complete statement of the plan.

Summary of the Plan

In order to coördinate the efforts of a great number of teachers who are engaged in attempts to analyze the various industrial-arts subjects and the skilled trades for the learning units involved, the following plan is proposed:

How the Individual Shop Teacher Can Help

On account of the importance of such an analysis as a basis of effective teaching the following plan for coöperative effort is proposed.

1. Every teacher who is interested in such an analysis should join in this undertaking.
2. All industrial-arts subjects, as taught in the high school, are to be analyzed, for the learning units involved.
3. That the principal skilled trades are to be analyzed for the learning units involved.
4. Tentative analyses of the selected subjects, or trades, are to be published and distributed as rapidly as may seem practicable.
5. Any shop teacher or supervisor who is willing to coöperate, or to offer suggestions in the way of modifying, adding to, or taking from, the original list, should send such suggestions or comments to R. W. Selvidge, University of Missouri, Columbia, Mo., or to William T. Bawden, Peoria, Ill., chairman of the committee.
6. Suggestions thus received should be carefully studied, edited, and incorporated, as far as possible, into the original lists, and the revised lists published, together with the names of those who coöperate.
7. Those who are interested should send in the analysis of any subject, or trade, which they have prepared, and which may be used by the committee as the basis of the preliminary analysis. This form of coöperation will be of great value in getting more satisfactory preliminary lists of units.

In order to get the project started, a tentative analysis of home mechanics follows. Those who are interested in coöperating in this matter are asked to study this outline with the view of adding to it anything that should be taught which is not in the list and striking out anything which should not be taught. Teachers should feel free to change the wording of any item to make it more definite, or more inclusive, or more exclusive.

In the study of the tentative analysis the best plan for the teacher is to take some of the jobs which he is using in his shop and analyze them with regard to this list of learning units. Perhaps the easiest way of doing this is to place the learning units in a vertical column, the jobs in a horizontal column, and check each unit in the column in which the job appears. *There must be definite working drawings and specifications for each job, or a correct analysis is impossible.* If it is found that the jobs contain learning units not in the list, such units should be added.

*University of Missouri, Columbia, Missouri.

In preparing a list of the learning units in home mechanics it is necessary for us to have a common understanding of what we are trying to do and why we are trying to do it. There are certain activities in and about the home which should fall to the lot of men just as distinctly as other duties fall to the lot of women, and men should be able to perform them as efficiently as women perform their duties. These duties involve the care and upkeep of the house, its equipment, and its surroundings. We should not ignore the fact, however, that many of the duties formerly performed by women in the home are now performed elsewhere, and many of the home tasks formerly performed by men are now performed by specialists in the particular field of work involved. No training we can give will check this social and economic development. It is just another phase of our growth from fireside production to factory production. We cannot go backward to "the good old times" when every family supplied its own needs. The thing we can do is to take advantage of the present situation and tendencies in order to give the boys experiences which will develop them into happy, useful, and successful citizens under present conditions.

Attitudes, interests, and habits of thought and action are of much greater importance than specific skills. Any kind of home tasks which will direct the boy's attention to the care of things in the home, increase his interest in having things neat and orderly, and give him pride and confidence in his ability to do things, are worth while. These duties usually consist of small adjustments, minor repairs, and preventive measures.

A Tentative Analysis of Home Mechanics

Work of this character does not require a high degree of manipulative skill. If it did the ordinary householder would not be able to do it. He does not have the time, nor does he have sufficient practice, to become skillful in a wide range of activities. He can undertake, successfully, only those things involving operations which are relatively simple and in which a high degree of accuracy is not required. In most of the minor jobs to be done about the home it is much more a matter of will to do, and a knowledge of how to proceed, than it is a matter of skill.

If the experiences really are to function in the home, they must involve the use of relatively few and inexpensive tools. For example, so few homes are provided with pipe cutters, stocks, and dies, necessary wrenches and vise, and the necessity for pipe fitting is so infrequent, that it is doubtful whether pipe fitting should be included in the list of instruction units with any expectation that it would be practiced by the boy in his home. It may be justified on other grounds, but not as a practical home activity of any wide use.

The principal purpose of the work should be to develop desirable attitudes, and habits of thought and action, rather than a high degree of skill in a variety of activities. It should develop a habit of observing how things are done, why they are done in a certain way, and the habit of carefully analyzing and planning tasks before they are begun. These are among the most valuable habits a boy can form.

In addition to the general considerations stated, we should keep in mind the following points in selecting the items of the list. We should select experiences which will give the boy an opportunity to learn:

1. The things which practically every man needs to know how to do, without respect to his vocation.
2. The things which a boy should be able to do in order that he may contribute his share to the upkeep of the home, meet his own needs, and develop an interest and pride in his home surroundings.
3. The things which will tend to make him self-reliant and give him confidence and pride in his ability to meet different situations.
4. Things which will give him the training necessary to enable him to do small jobs in connection with the upkeep of the home, and thus save the time and money which would be involved in calling in "experts."
5. The proper use and care of the house and household equipment.
6. The things which will enable him to maintain a higher standard in his home surroundings with a smaller expense.
7. The things which will give him a better understanding of, and a greater interest in, the things with which he comes in daily contact.

A number of the more frequently used skills are listed because they are necessary in so many jobs. It is not expected that these will be taught without respect to jobs. However, if instructions are prepared for these fundamental operations, such instructions can be used on any job in which the operations are involved, and it will not be necessary to repeat the instructions for each job, nor will it be necessary to have the jobs arranged in any fixed sequence. For example, *How to fasten with screws,* or *How to solder,* represent operations which require instruction, and which are involved in a great many jobs. Instructions prepared for these operations may be used on any job in which fastening with screws or soldering is involved. If well-prepared instructions in these fundamental processes are available for the pupil, and he has made a satisfactory plan of procedure for the job, most of the more serious difficulties involved in such work are removed.

Most of the skills in which the boy will require instruction at some time are placed first in the list. If instructions are prepared for these, they may be used in any of the jobs which follow, if needed. The jobs listed are only representative and suggestive. The ones used should be based upon actual needs in the home, insofar as possible, but we must be careful to see to it that the boy *learns* something as well as *makes* something.

The Learning or Teaching Units

The Things the Student Should be Able to do:

1. Nail and draw nails.
2. Use a saw.
3. Fasten with screws.
4. Fit and lay linoleum.
5. Shape a screw-driver tip.
6. Sharpen knives.
7. Sharpen scissors or shears.
8. Sharpen a garden hoe or shovel.
9. Sharpen plane bit and chisel.
10. Sharpen hand sickle.
11. Adjust a lawn mower.
12. Use a cold chisel.
13. Use a wrench.
14. Use pliers and wire cutters.
15. Splice wire.
16. Use a hand drill.
17. Bore holes with auger bit.
18. Use a file.
19. Put hangers in plastered walls without breaking plaster.
20. Repair holes in plastered walls.
21. Prepare and use glue.
22. Cut and set glass.
23. Fit keys to a lock.
24. Adjust and repair rim lock or mortise lock.
25. Put new wire on screen frames.
26. Set or adjust butt hinges.
27. Fit a tool handle.
28. Tighten loose joints on a chair or other furniture.
29. Use corner braces and mending plates in repairing furniture.
30. Put knobs or pulls on drawers.
31. Attach casters and glides.
32. Reseat chairs.
33. Repair upholstering.
34. Remove old finish from furniture.
35. Refinish furniture.
36. Clean and refinish floors.
37. Apply paint on old and new surfaces.
38. Use lacquer and enamel in home decoration.
39. Paint pipes and radiators.
40. Clean and care for paint brushes.
41. Install electric bells.
42. Renew carbon brushes in small motor.
43. Renew fuses.
44. Wire a socket and plug.
45. Read gas and electric meters.
46. Regulate mixer on gas burner.
47. Repair faucets.
48. Solder.
49. Repair flush tanks.
50. Clean out traps in sink and floor drain.
51. Remove stoppages from pipes.
52. True up a door that sags or binds.
53. Adjust a window sash that binds.
54. Replace sash cord and weights.
55. Repair and hang window shades.
56. Wrap and tie packages properly.
57. Tie Boy Scout tenderfoot knots.
58. Read working drawings.
59. Plan the procedure in doing a job.
60. Develop habit of observing how jobs are done.
61. Mix and pour concrete.
62. Finish concrete surfaces.
63. Care for house furnace.
64. Care for tools to prevent rust.
65. Put up a clothes line.

The Things the Student Should Know:

1. How to distinguish some of the more common woods in general use in the community and know their principal characteristics and working qualities.
2. The effect of moisture on wood.
3. How to protect and preserve woods.
4. The nominal and actual standard dimensions of lumber.
5. The object of wood finishes.
6. The durability of different kinds of finishes.
7. The materials from which finishes are made.
8. The kinds and sizes of nails and their uses.
9. How nails are sold.
10. Sizes of brads and how sold.
11. Sizes, kinds, and uses of corrugated fasteners.
12. Kinds and sizes of screws and how they are sold.
13. Kinds and grades of sandpaper.
14. Grades and uses of steel wool.
15. Kinds and grades of sharpening stones.
16. How sizes of auger bits and drill bits are indicated.
17. The names of different kinds of pipe fittings.
18. How water pipe is dimensioned.
19. The names of the different kinds of plumbing fixtures and fittings.
20. The names of different kinds of wrenches and the purposes for which each is used.
21. The sizes of wire.
22. The kinds of rope and methods of dimensioning.
23. The distinguishing characteristics of the more common metals, such as cast iron, wrought iron, tool steel, brass, copper, aluminum, and their more common uses.
24. The gauges of sheet metal.
25. The effect of heat on metal.
26. Safety with respect to home electrical appliances and other equipment.

What the Student Should be:

This list of attitudes and habits which contribute to the success of individuals in May, 1931, issue of this magazine, and need any vocation was given on page 191 in the not be repeated here.

RADIO BENCH A POPULAR PROJECT

Clayton S. Hoyle, Jamestown, New York

This radio bench is very popular with eighth-grade junior-high-school boys who are just being introduced to the uses of the band saw. Several review processes are brought in, and the new machine work is presented in an interesting manner. It is also a welcome new object for the home, where it may rightfully be used as a complement to the piano bench.

The construction is simple yet exacting, if it is to stand square and look well. The sides are fastened to the brace with 1¼-in. No. 9 r.h.b. screws. Philippine mahogany was found to be well adapted to this project.

The shaping of the sides and the brace offers many chances for individual design. Those not able to design for themselves may work out the design on the drawing by means of the 1-in. squares. Patterns may also be provided where necessary.

The 1931 A.V.A. Convention

The sixth annual A.V.A. convention which was held in New York City, December 9, 10, 11, and 12, was well attended considering present-day conditions. The general meeting on Wednesday evening took the form of an inspection trip through the Textile Evening High School and a get-acquainted party conducted by the Ship in conjunction with the Vocational Teachers' Association of New York City.

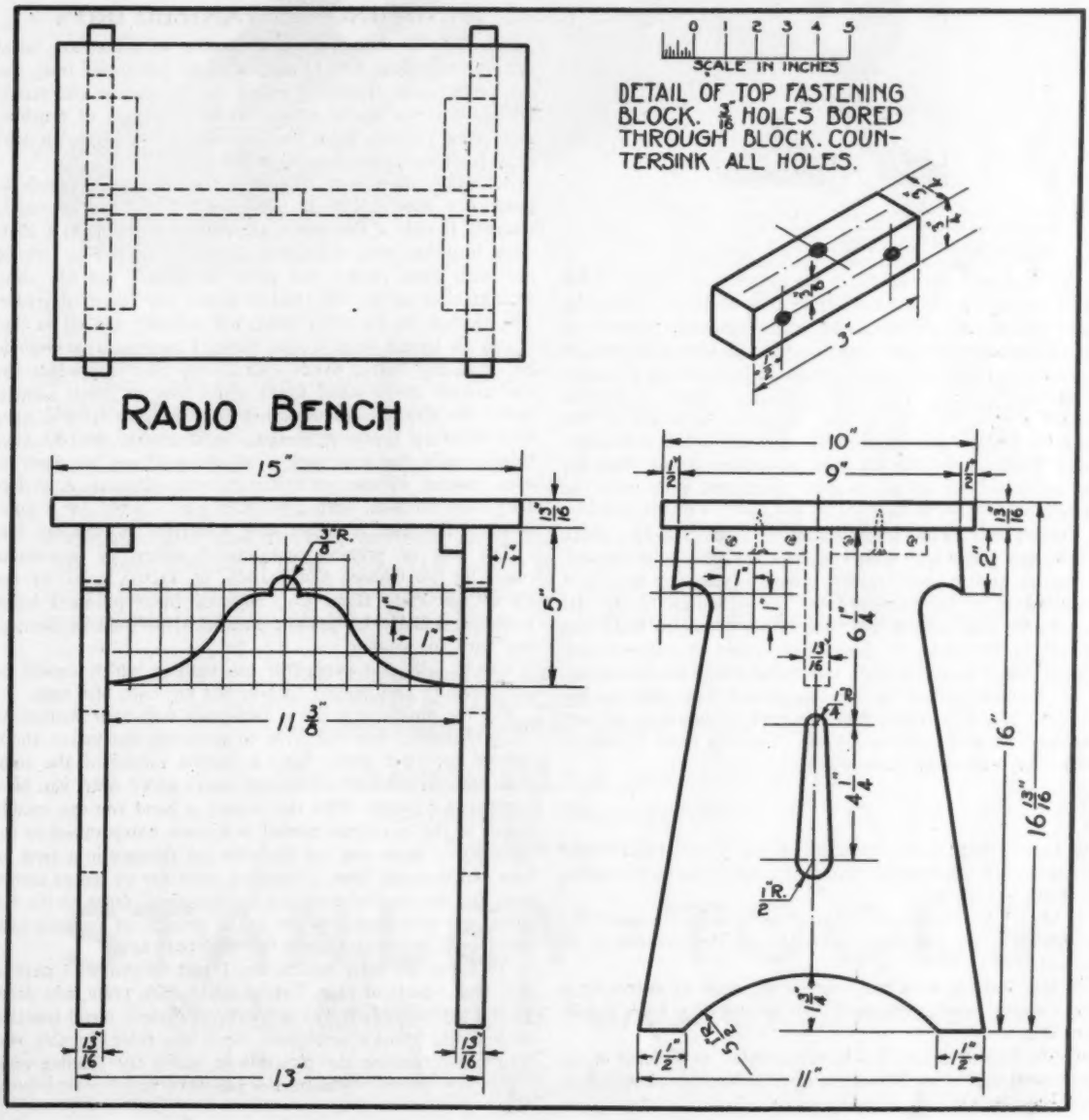
The general and sectional meetings throughout the convention were all well attended. At the general sessions there were such notable speakers as Dr. George J. Ryan, president board of education, New York City; J. E. Edgerton, president National Association of Manufacturers, New York City; Dr. John Dewey, New York City; Louis I. Dublin, vice-president Metropolitan Life Insurance Company, New York City; Matthew Woll, vice-president American Federation of Labor, Washington, D. C.; and Charles A. Prosser, director Dunwoody Institute, Minneapolis, Minnesota.

The sectional meetings of especial interest to the readers of INDUSTRIAL ARTS AND VOCATIONAL EDUCATION were those confined to industrial arts and vocational education.

Thursday morning the general trends in American industry, industrial-arts management, and labor legislation were discussed by various experts drawn from fields other than that of teaching. In the afternoon, electrical and chemical research and their effect on industrial development were discussed. At this session Dr. Phillips Thomas, research department Westinghouse Electric and Mfg. Co., East Pittsburgh, Pa., delighted and mystified his hearers by his demonstrations in which he performed the almost unbelievable. Evidently he has his electrons thoroughly trained, because they readily followed his commands so that it was possible for him seemingly to blow out the electric lights in the room, relight them from a distance, operate stop and go lights, show pictures of the sound waves made by the human voice, and to discover and put out fires. His demonstration and lecture was exceedingly entertaining and educational.

The industrial-arts program held Friday morning at nine o'clock under the chairmanship of Prof. Arthur B. Mays, University of Illinois, Urbana, contained a great deal of interest. P. L. Cressman, assistant director of vocational education, Harrisburg, Pa., at this meeting discussed the "Junior

(Continued on page 14A)



AMONG INDUSTRIAL-ARTS TEACHERS

ANOTHER PIONEER DIES

Jonathan E. Painter, for the past 38 years supervisor of industrial-arts work in Minneapolis, Minnesota, died Wednesday, January 6, 1932, after an illness of about ten weeks.

Mr. Painter was born in Licking county, Ohio, November 29, 1863. It was here also that he received his elementary and high-school education. His professional training was obtained at the Ohio Normal University and at the Boston Sloyd School of Manual Training.

JONATHAN E. PAINTER
From a portrait made in 1902

His teaching career began in the elementary schools of his home county where he served from 1884 to 1888. During the years immediately following, he taught academic subjects in the high schools of Knox county, Ohio. In 1891 and 1892 he was a teacher in Leversidge Institute of Industry at Matapan, Massachusetts, and the North Bennett Street Industrial School, Boston. In 1893 he was appointed supervisor of the manual-training department in the only high school then existing in Minneapolis, and has been supervisor of that work for the public schools of Minneapolis from that time until the present.

Under Mr. Painter's guidance the industrial-arts work taught in a single high school in 1893 has steadily developed. It passed through the transition caused by changing the school organization in Minneapolis from the eight-four to the six-three-three plan until at the time of his death the work was carried in 17 grade, 11 junior-high-school, 3 junior-senior-high-school, 2 four-year high, and 3 senior-high-school centers.

Mr. Painter has set an enviable record. Exemplary as has been his life, it is reflected in the lives of thousands of men and teachers who in his long years of service came in contact with him. — *Dean M. Schweickhard.*

—◎—

¶ Mr. Ludwig Lang, principal of the Vocational Printing Trade School, Cincinnati, Ohio, died at his home on December 1, at the age of 58.

¶ Mr. C. W. Richards has been appointed state supervisor of rehabilitation education in Oklahoma. He succeeds A. H. Abbott.

¶ Mr. John Geiger has been appointed as an instructor in the evening printing class of the vocational school, Appleton, Wis.

¶ Mr. Frank Mann has been appointed as director of the vocational school at Menomonie, Wis. Mr. Mann will have charge of the night-school work, as well as the part-time vocational work.

¶ Mr. J. H. Wikstrand, Superior, Wis., has been appointed as a member of the state board of vocational education. Mr. Wikstrand succeeds Mr. Alex McTaggart.

¶ Mr. J. R. Dryden is teacher of general metal work in the William Howard Taft Junior High School, Oklahoma City, Okla.

¶ Mr. J. Paul Shaw, of Benson, N. C., has been named as master teacher of vocational agriculture in North Carolina.

¶ Mr. W. R. Challoner, machine-shop instructor in the Vocational School at Appleton, Wis., has received the honorary senior Class A rating from the State Board of Vocational Education.

NOW, ARE THERE ANY QUESTIONS?

FINISHING GALVANIZED IRON

955. Q.: We are making a number of pieces of metal cabinetwork, using No. 14 and 16 gauge galvanized iron, and are having some trouble in giving them a smooth and elastic finish. Will you kindly advise me of a process of finishing such work to give them the smooth olive-green finish that is so common in commercial work? — *E. T.*

A.: Galvanized iron is a tricky surface upon which to produce a good finish. It must first of all, be thoroughly cleaned. If only a few pieces are to be finished, then a thorough brushing with denatured alcohol, followed by wiping dry with clean cloths, will prove successful. Do not clean with gasoline as this will tend to spread any traces of grease. The alcohol, on the other hand, will saponify the oil so that it can no longer form a film. Since I presume that you do not have any baking ovens such as are used to produce the commercial olive-enamel finish which you so much admire, it will be necessary to use air-drying materials. If you have a satisfactory spray equipment, so much the better, since this is really the only way in which metal can be given an even coating without an undue number of coats. A ½-h.p. DeVilbiss machine, with Type CH gun is ideal for school-work of this kind, together with a suitable HJ exhaust fan.

The first or priming coat should consist of Galvanum, made by the Goheen Corporation, or Tector, made by the Pittsburgh Plate Glass Co., both of these products being made particularly for priming galvanized iron. Allow them to dry hard for sanding.

Use a split 6/0 paper for the sanding which should be done lightly, and enough to take out any nibs and sags.

For the finish coats, use a high-grade four-hour enamel. In all probability, you will have to make up the match shade needed for your work. Keep a careful record of the color base and the amounts of tinting colors added until you have arrived at a match. With this record at hand you can readily arrive at the quantities needed to make a batch suited to the quantity of work you are likely to put through in a term or two and thus will have a matched color for all pieces turned out. For this type of work use the "eggshell" finish as the full gloss will overemphasize the small defects of manufacture. Sand each undercoat; leave the final coat alone.

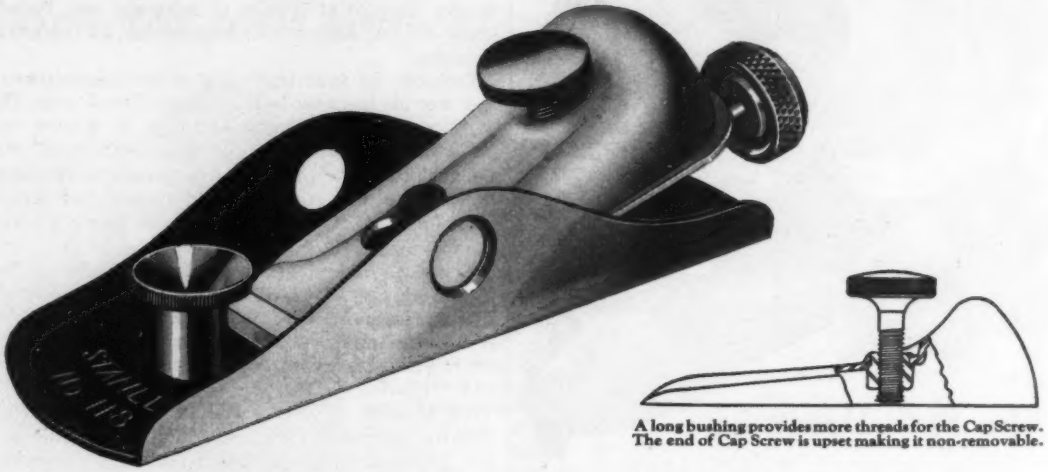
To make the color match, use 1 part of yellow, 1 part of red, and 2 parts of blue. Take a white china plate, add drops of the well-stirred enamel in the order named, blend together with a fine artist's brush and check the color. In this way you can determine the direction in which the shading must

(Continued on page 14A))

Announcing an Improvement

on the

Stanley "Boy-Proof" Block Plane



A long bushing provides more threads for the Cap Screw. The end of Cap Screw is upset making it non-removable.

THE addition of a long bushing in the lever cap of the Stanley All Steel Block Plane No. 118 provides more threads for the Cap Screw. The end of the Cap Screw is upset to make it non-removable.

Designed for use in the School Shop, All Steel Block Plane No. 118 combines the features which are sought by instructors in their efforts to get a "boy-proof" plane. The 1⅝" cutter is held at a very low angle to plane end grain easily. The plane has few removable parts, no mouth adjustment and the finger rest is riveted in place.

Instructors who have purchased Stanley No. 118 Block Planes that have the old style lever cap without the bushing may secure new lever caps, no charge, by returning the old ones when they wear out.

This useful tool is but one of the hundreds described in our Tool Catalog No. 34A. Send for a copy together with the special School Index

THE STANLEY RULE & LEVEL PLANT
Educational Department
New Britain, Conn.

STANLEY TOOLS

Stanley Equipment is Standard Equipment

STANLEY TOOLS

The *Safe* Hammer at a new low price

For years you've been seeing advertisements of the Plumb Nail Hammer, with all of its exclusive features, developed by carpenters in actual use. And the price was $1.50.

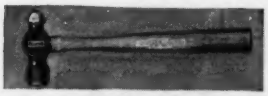
Now you can get this hammer for $1.00. Every feature is intact, including that safety device so important in schools—the Plumb Take-Up Wedge which keeps the handle tight by a turn of the screw.

No change from the quality, design and finish that made the Plumb the leading seller to mechanics and tool lovers—no change except a drastic reduction in price.

Your boys need the best, and when the best costs no more than an ordinary hammer, give them Plumb. Specify HF81 for 16 oz. head — HF82 for 13 oz. head.

Fayette R. Plumb, Inc., Philadelphia, U. S. A.

For the school metal-working shop



Plumb Ball Pein
HF372 — 12 oz. — $1.00

Get the same Plumb quality in Ball Peins, at new, low prices. Same high-grade steel, same perfected design, same safety feature which marks every Plumb Tool as the product of expert craftsmen. Other models at proportionate prices.

PLUMB
DOUBLE LIFE
Hammers Hatchets
Files Sledges Axes

(Continued from page 72)

go, and if the count of the color drops is kept, you have a reasonably accurate measure of the quantities needed.

Let all coats of enamel dry at least 24 hours before recoating. Let the last coat dry two days before putting in service. — *Ralph G. Waring.*

THE 1931 A.V.A. CONVENTION

(Continued from page 71)

Mechanics' Club Work" which is gaining more and more ground. By means of this work thousands of boys will be led into the formation of proper habits, acquiring at the same time training for leisure which is becoming so very important in this day and age. Roy G. Fales, state supervisor of industrial arts, Albany, New York, discussed ably the "Development of a State Program of Industrial-Arts Education," and C. F. Bauder, director of division of industrial arts, Philadelphia, spoke on the subject of "Improvement of Industrial-Arts Teaching."

Probably the most interesting of the industrial-arts meetings was the luncheon held at twelve o'clock noon Thursday at Hotel Governor Clinton. Dr. Wm. E. Warner, associate professor of industrial arts education, Ohio State University, Columbus, was the chairman. The purpose of the dinner was to honor men now in positions of leadership who began teaching before 1900. Among those who were guests of honor were the following:

Edgar S. Barney, principal, Hebrew Technical Institute, New York City, 1884; Robert H. Smith, professor, Massachusetts Institute of Technology, Cambridge, 1886; Charles A. Bennett, president, The Manual Arts Press, Peoria, Ill., 1887; Frank M. Leavitt, associate superintendent, Pittsburgh, 1887; Charles R. Richards, executive vice-president, New York Museum of Science and Industry, 1887; William E. Roberts, supervisor, Cleveland, 1887; David Snedden, professor, Columbia University, 1889; Clifford B. Connelley, Carnegie Institute of Technology, Pittsburgh, 1890; George M. Gaither, supervisor, Baltimore, 1890; Charles A. Kunou, supervisor, Los Angeles, 1890; Joseph Sandberg, principal, Boston, Mass., 1890; Joseph C. Park, professor, Oswego, 1891; George F. Hatch, assistant director, Boston, 1892; Arthur W. Richards, Ethical Culture School, New York City, 1892; Edward W. Boshart, professor, State College, Raleigh, N. C., 1893; Maris M. Proffitt, senior specialist, United States Office of Education, Washington, D. C., 1894; Clinton S. Van Duesen, professor, State College, Kent, Ohio, 1894; William T. Bawden, editor, The Manual Arts Press, Peoria, Ill., 1896; Ernest B. Kent, supervisor, Jersey City, 1896; Augustus F. Rose, director, Providence, R. I., 1896; Robert G. Weyh, assistant director, New York City, 1896; James F. Barker, assistant superintendent, Rochester, N. Y., 1897; Michael W. Murray, director of practical arts, Newtonville, Mass., 1899; Leonard W. Wahlstrom, Francis Parker School, Chicago, 1899; and Robert W. Selvidge, professor, University of Missouri, Columbia, 1900.

At the Saturday industrial-arts meeting Mr. Bauder, of Philadelphia, substituted for Mr. Clyde A. Bowman as chairman. At this meeting, Dr. Wm. T. Bawden, chairman of the Committee of Standards in Industrial Arts, made his report of progress, as did also Geo. K. Wells, state supervisor trades and industries, Indianapolis, Ind., who substituted for Roy R. Van Duzee, supervisor of industrial arts, West Allis, Wis., chairman of the Committee on Tests and Measurements in Industrial Arts. The reports from both of these Committees show that they are grappling with a difficult problem, and one which will need the coöperation of every earnest industrial-arts teacher in the United States.

The industrial-education program on Friday morning, under the chairmanship of Mr. Robert O. Beebe, director Essex County Vocational Schools, Newark, N. J., embraced discussions on the "Industrial Survey as a Means of Keeping in

(Continued on page 23A)

Let us send your copy of this new LATHE BOOK...

A valuable aid to both instructor and student

Here's the newest, most up-to-date book on the operation and maintenance of geared head engine lathes. It contains a mass of new and valuable information, told so simply and with such clear diagrams that the student will find it especially interesting as he puts into practice the theories he is trying to learn. This new 70-page lathe book, in the hands of the student, makes it easier for the instructor. It enables the student to advance more rapidly.

TELLS ALL ABOUT LATHE WORK

—Grinding, Centering, Attachments, Methods of Holding Work, Cutting Speeds, etc.

"Encyclopedia of Lathe Operation" would be a good name for this book—it's so complete. Ten big chapters, from the setting up of a lathe to a series of valuable machinists' tables, fill its profusely illustrated pages. The instructions on leveling a lathe, checking the motor and proper lubrication, will give the advanced student many helpful hints, and help the beginner as he tries to learn lathe fundamentals.

There is a big chapter dealing with lathe tools, their purposes and how to use them correctly. Then follows proper grinding of lathe tools. Centering work and methods of making tests. Information on cutting speeds, and the correct speeds for running on different materials. "Chatter" is thoroughly discussed, telling its cause and how to get rid of it.

Install a Regal— the "safety-first" lathe will produce better results for the student

The Regal is safe, unusually accurate and modern. It is a compact, completely self-contained unit with motor mounted on left leg well off the floor. The elimination of exposed belts and shafting gives the student maximum operating safety, and makes the Regal ideal for instruction purposes.

Regal lathes are built by LeBlond and subjected to LeBlond precision tests before leaving the factory. They are equipped with 8-speed selective geared headstocks that make speed and feed changing sure and simple. Feed rod takes wear and tear off lead-screw. Deep, rigid bed of close-grained nickel steel alloy iron. All moving parts enclosed. Built-in motor has V belt drive. Lathe furnished with all necessary equipment, ready to operate. Made in five sizes, 10" to 18". Prices range from

$275.00 to $947.00

F. O. B. Factory

Catalog Free

Along with your copy of the Lathe Book let us send you our new 1932 Catalog FREE. It contains pictures, descriptions, diagrams of 1932 Regal lathes, units and accessories. Get your copy and see for yourself how much a Regal lathe offers.

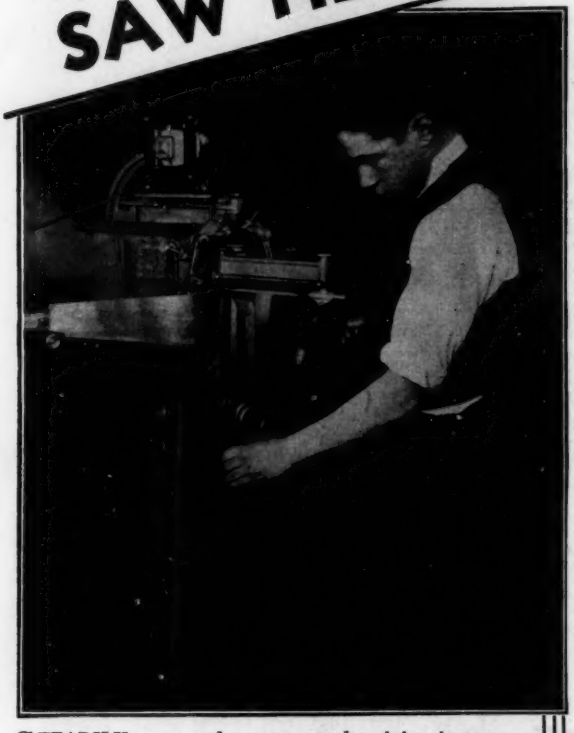
ATTACH THIS COUPON TO YOUR SCHOOL LETTERHEAD AND MAIL TODAY

THE R. K. LE BLOND MACHINE TOOL CO.

CINCINNATI OHIO, U.S.A.

REGAL — BUILT BY LE BLOND

Let your students do your SAW FILING



STEADILY more and more manual training instructors are letting their students keep the school saws in condition with the Foley Automatic Filer. Not only does its use relieve the teacher of the tedious work of filing saws, but this training is a valuable asset to the student. Foley Saw Filers are used in hundreds of manual training departments and throughout the woodworking industry.

FOLEY AUTOMATIC SAW FILER

One Machine Files All Saws

All kinds of hand saws, band saws, and cross-cut circular saws are filed automatically with absolute precision and uniformity on the Foley—and jointed at the same time. Every tooth is filed exactly uniform in size, height, and spacing—every tooth cuts.

Investigate the convenience and economy of having a Foley Filer. It is one of the best investments your school can make. Saves money, work, and worry. Send coupon for complete information.

oley Auto-

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NEW PUBLICATIONS

Light and Power Wiring

By B. B. Burling and James H. Lauerman. Paper, 8¼ by 10¾, illustrated. Price, $1.25. Published by The Bruce Publishing Company, Milwaukee, Wis.

This is the fifth edition of these well-known job sheets on electricity. They have been thoroughly revised and brought up to date. They will be especially welcomed by teachers who are training electricians for the trade.

Essentials of Electricity

By W. H. Timbie. Cloth, 306 pages, 5 by 7¼, illustrated. Price, $2. Published by John Wiley & Sons, Inc., New York City.

This well-known little book on electrical principles is appearing in a new, revised edition. Its many friends will, no doubt, welcome the old text in the new form, which, due to the revision, is now thoroughly up to date.

Problems in Architectural Drawing—Book II

By F. G. Elwood. Cloth, 88 pages, 7⅞ by 11, illustrated. Price, $2. Published by The Manual Arts Press, Peoria, Ill.

This book is a companion to Volume I by the same author. It presents in a compact form some of the simpler types of the uses of masonry and steel construction in commercial, public, and domestic buildings.

Food Problems in Families of Vocational School Students

Under this heading the Milwaukee Vocational School has printed a monograph which was prepared by Hattie E. Anderson and Harry S. Belman of the Division of Instruction and Research, which contains a very extensive study of the kinds of food eaten in the families from which the students of this school come. The information contained in the monograph is exceedingly interesting and will, no doubt, be found very valuable to teachers of home economics in schools of all kinds.

Installing and Operating Exide Batteries

Paper, 14 pages. Issued by the Electric Storage Battery Co., Philadelphia, Pa. The booklet tells in brief, but concise form, how to put a battery into service, gives directions for its care and operation, and offers other practical information.

Fundamentals of a Storage Battery

Paper, 8 pages. Issued by the Electric Storage Battery Co., Philadelphia, Pa. The booklet describes the operation of a storage battery, shows how a change in plates is made during discharge and charge, and offers information concerning the chemical action, low temperature, gas, and sulphate.

How to Get the Job You Want To Him That Hath—

By William L. Fletcher. Published by William L. Fletcher, Inc., 8 Newbury Street, Boston, Mass.

The first is a substantially bound volume of 361 pages, and the second, a paper-covered book of 90 pages. Both were written by a man who is the head of a large placement bureau for high-grade men who are able to qualify for executive positions. These books contain much that is of great value to the teacher who is confronted with the problem of educationally and vocationally guiding those who attend his classes, and who eventually also must assist these students in their search for employment.

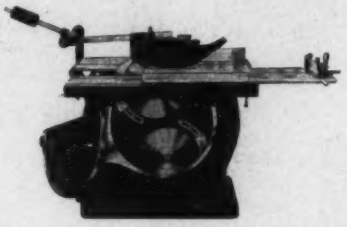
ADVERTISING PAGES REMOVED

SCHOOL SHOP EQUIPMENT NEWS

FOR THE SUPERVISOR OR TEACHER WHO DESIRES TO KEEP ABREAST WITH THE NEWS OF NEW MACHINERY, TOOLS, SUPPLIES, ETC.

NEW OLIVER DOUBLE-ARBOR UNIVERSAL SAW

The Oliver Machinery Company, of Grand Rapids, Mich., has announced its new No. 260 double-arbor universal saw as a distinct forward step in direct motor-driven woodworking machinery.



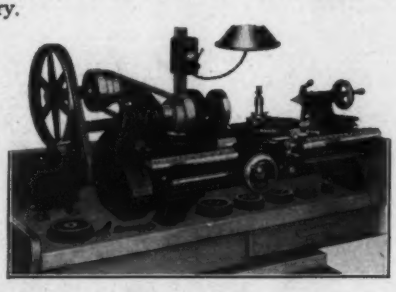
The machine, which is intended for use where one machine is desired for both ripping and crosscutting, may be used for either ripping or crosscutting by merely turning a handwheel which swings the yoke carrying the two motor-driven saw arbors. It is extremely accurate, simple, and self-contained. The shaftless motor, which is built in directly on each of the two ball-bearing saw arbors, is compact, insures economy, safety, greater convenience, and more ease in operation and maintenance. The tilting table has a rolling section and universal ripping fence, together with a full equipment of miter cut-off gauges, circular segment gauge, guard, etc., which make it a truly universal saw bench.

Complete information and prices will be sent to any school-shop instructor on request.

—◎—

NEW SOUTH BEND SHOP AND LABORATORY LATHE

The South Bend Lathe Works, South Bend, Ind., has just placed on the market a new 8-in. junior back-geared screw-cutting lathe for general-purpose use in the small shop or laboratory.



The lathe is built with a back-geared headstock, with a three-step cone providing six changes of spindle speeds — three direct for light machining at high speeds, and three back-geared for heavier work and slow speeds. Among the special features are a hollow spindle of alloy steel, an Acme precision lead screw of ¾-in. diameter, an automatic longitudinal feed to the carriage, a tailstock setover for taper turning, and a screw-thread chart for cutting threads from 4 to 40 per inch. The lathe is furnished in bed lengths of 24, 30, 36, and 42 in., and with all attachments for special work. The lathe is motor-driven and is equipped to insure 1800 r.p.m.

The lathe will perform all types of turning, facing, boring,

(Continued on page 20A)

AMAZING

what you can do with *genuine*

PLASTIC WOOD

comes in 9 colors

If you've anything to mend around the house—a nick to hide, a hole to plug, a crack to fill up—Plastic Wood will do a better and quicker job than anything else you could use. It's a remarkable preparation. Though it handles like soft putty it quickly hardens into wood — wood that outlasts natural wood—wood you can carve, paint, turn in a lathe—wood that holds screws and nails.

If you want to model anything—an intricate pattern, a fanciful dragon, a ship, a picture frame or a pair of bookends — discover how much better you can do it with Plastic Wood. Manual training teachers, pattern makers, amateur sculptors and tinkers who like to work with their hands find they get the best results with this marvelous preparation.

SPECIFICATIONS for Industrial Uses

Tensile Strength	1500 lbs. per sq. inch
Crushing point	3000 to 4000 lbs. per sq. in.
Weight per Cubic Foot	30 lbs.
Absorption, Fresh Water	30%
Absorption, Oil	33%
Hold upon small screws (White Pine at 100)	143%
Combustibility, inception (charring)	400° to 500° F.

BEWARE of Imitations

Plastic Wood is one of the greatest discoveries of the age. And like all great discoveries it has many imitators. If you want the very best at no additional cost, refuse substitutes and DEMAND PLASTIC WOOD by name. It is sold in 9 colors by all paint, hardware and department stores.

BIG 48-PAGE BOOK OF FACTS

We'll send you FREE—a 48-page, profusely illustrated book crammed full of facts about Plastic Wood and how to use this amazing preparation.

MAIL FOR FREE BOOK

The A. S. Boyle Co., Dept. IA-2 Cincinnati, O.

Send me—free—Big Book of Uses for Plastic Wood.

Name.....

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THIS OFFER GOOD IN UNITED STATES ONLY

■ POST'S WATERPROOF DRAWING INK ■
■ ■ FOR CLEAR SHARP BLUEPRINTS ■ ■

Delicate lines of tracings made with Post's Waterproof Drawing Ink are jet black and opaque—perfect subjects for blue printing.

The quick drying feature of Post's Waterproof Drawing Ink guards against smeared drawings. It is available in black and twelve brilliant colors.

THE FREDERICK POST CO.

P. O. BOX 803 CHICAGO, ILL.

CANADIAN DISTRIBUTORS FOR POST PRODUCTS, THE HUGHES OWENS CO., LTD.

(Continued from page 19A)

chucking, drilling, tapping, tapering, reaming, grinding, and polishing. Complete information and prices may be obtained by any school-shop instructor upon request.

—◎—

LEBLOND ISSUES NEW LATHE CATALOG

The LeBlond Machine Tool Company, Cincinnati, Ohio, has issued a booklet entitled *Running a Regal*, which comprises a manual of lathe operations and maintenance.

The manual, which presents the basic principles of lathe operation to the student, the apprentice, and the mechanic, represents the results of 25 years of experience in the manufacture of engine lathes. It describes the Regal line of general-head precision lathes, tells how to set up a lathe, describes methods of holding the work in the lathe, grinding lathe tools, and operations in drilling, reaming, and tapping.

IAVE NEWS —— NOTES

Teacher-Training Center

The New York State Education Department maintains an industrial teacher-training center in New York City, under the direction of Mr. G. C. Weaver. The courses are offered in the evening to persons holding local positions of responsibility in the field of vocational education.

Approximately 375 persons qualified to teach Smith-Hughes classes are in training. A state certificate to teach a particular subject is given to each student who completes 32 credit hours (480 clock hours) of work.

New Vocational High School at Madisonville, Ky.

The new colored industrial high school, just completed at Madisonville, Ky., at a cost of $40,000, offers facilities and equipment for vocational classes in dressmaking, carpentry, plastering, bricklaying, and electric wiring. The school was financed with an appropriation of $8,100 from the Julius Rosenwald Fund.

Government Motion-Picture Films

A comprehensive series of educational motion-picture films depicting the automotive and allied industries, comprising The Story of a Gasoline Motor, The Story of Gasoline, The Story of a Storage Battery, Heat Treatment of Steel, The Story of a Spark Plug, The Story of Lubricating Oil, Automobile Lubrication, Carbon Monoxide, and The Power Within. Copies of the films may be obtained by any school by writing to the Pittsburgh Experiment Station of the U. S. Bureau of Mines, Pittsburgh, Pa.

Open New Machine Shop at Hadley School, St. Louis, Mo.

A new machine shop has been opened at the Hadley Vocational School, St. Louis, Mo. The shop has been fully equipped and offers increased facilities for machineshop practice. The courses include part-time classes for machinist apprentices, as well as classes in mathematics, drawing, and science.

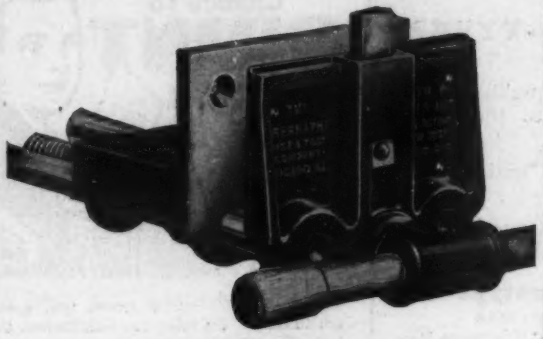
New Manual-Training Equipment at Kansas City, Mo.

The board of education at Kansas City, Mo., has installed manual-training equipment in the new addition to the East

(Continued on page 23A)

ADVERTISING PAGES REMOVED

— ABERNATHY —
ROLLER NUT Rapid Acting VISES



give the most satisfactory service in school shops because of their Simplicity, Strength and Refinement of construction.

Write for copy of our latest circular.

ABERNATHY VISE & TOOL CO.
2842 West 26th St. CHICAGO, ILLINOIS

Seventeenth Annual Catalog
"Hard-to-Get" Materials
How Often Have You Wished to Find a Source of Supply for the Following?

Upholstering materials and supplies, finishing materials, mirrors, Sloyd knives, candlestick sockets, foot rests for shoe blacking boxes, electric bridge arms and clusters, furniture slides, bed rail fasteners, office chair fixtures, decorative transfers, smoker trimmings, furniture legs, tea wagon wheels and casters, furniture mouldings and pressed ornaments, chest trimmings of every kind and description, casters in large variety, wood dowels, nut bowl fittings, billboard clamps, screw hole plugs, knobs, pulls, catches, hinges, costumer hooks, tray handles, desk lid supports, chair cane and reeds, table slides, folding card table fittings, corner braces, steel rails for wood beds, table leaf supports, spring clock movements, electric clock movements for both mantel and grandfather clocks.
All the above and many more at wholesale prices.

Catalog Free for the Asking

Thurston Supply Co.
Anoka, Minnesota

(Continued on page 20A)

High School. The new building was erected at a cost of $400,000.

Syracuse Opens Apprentice Training School

A building used by the school system of Syracuse, New York, for a repair shop and storage, has been remodeled for use as an apprentice training school. The school has 164 students in the day classes and 215 in the evening classes.

Manual-Training Club Holds Meeting

The Manual-Training Club of Greenville, Ohio, held its regular bimonthly meeting. Mr. Bob Curtis gave a talk on the construction of amplifiers. Mr. Richard Lawrence told about the manual-training department of Lafayette, Ind.

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THE 1931 A.V.A. CONVENTION

(Continued from page 14A)

Touch with Changing Industrial Conditions" by Franklin J. Keller, director Vocational Education Survey, New York City; "The Vocational School as an Industrial Service Agency" by William J. Small, assistant superintendent of schools, Niagara Falls, N. Y.; "Opportunities for Industrial Training in a Small City" by C. H. Turner, supervisor vocational education, Phoenix, Ariz.; and "Recent Developments in Trade and Industrial Training in Full-Time School" by C. F. Klinefelter, special agent, Federal Board for Vocational Education, Washington, D. C.

Those who spoke on the full-time technical training program held Friday morning were Preston H. Smith, superintendent of schools, Bayonne, N. J.; W. R. Saunders, principal Northern Vocational School, Toronto, Canada; Albert L. Colston, principal Brooklyn Technical High School; and J. B. Wallace, principal High and Technical School, Sudbury, Ont., Canada.

At the apprentice-training session held at the same time under the chairmanship of Oakley Furney, chief Bureau of Industrial Education, Albany, N. Y., the apprenticeship-training programs were discussed by F. S. Rutherford, Toronto, Canada; Frank P. Johnson, Albany, N. Y.; Otto Carpenter, New York City; Frank Cushman, Washington, D. C., and Joseph Constantine, Passaic, N. J.

At a meeting at which the technical and industrial training for adults was discussed, also held on Friday morning at nine o'clock, A. S. Boynton, state director of vocational education, Hartford, Conn., was chairman, and those who discussed the various courses and training plans were: M. Reed Bass, Minneapolis, Minn.; Fred Shepperd, New York City; Charles Carroll, Providence, R. I.; George H. Parkes, Williamsport, Pa., and Arthur Wrigley, Elizabeth, N. J.

At the same time a group met to study the question of industrial teacher training. The chairman of this session was R. O. Small, state director of vocational education, Boston, and those on the program were M. Norcross Stratton, Boston; James F. Mason, Paterson, N. J.; Ronald W. Kent, Newark, N. J.; Ralph Pickett, New York City; and Russell J. Greenly, Akron, Ohio.

Besides the sessions already mentioned, there were others on foreman training and plant training, and numerous others on the various trades and industries.

At the business session held Friday afternoon, a total of about 200 life memberships to the Association were presented.

Dr. Wesley A. O'Leary, state supervisor vocational education, Trenton, N. J., was elected president of the Association for the coming year. Dr. Thomas H. Quigley, professor of industrial education, Georgia School of Technology, and Oscar M. Sullivan, state director of vocational rehabilitation, St. Paul, Minnesota, were elected vice-presidents, representing, respectively trade and industrial education and vocational rehabilitation. These vice-presidents will serve for three years.

The executive committee reported that Kansas City has been selected as the convention city for 1932.

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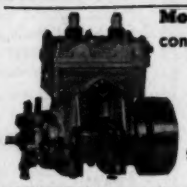

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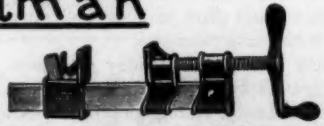

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